



LANDAU ASSOCIATES, INC.



Phase I 7.2.1
Quality Assurance Project Plan

**Colbert Landfill
Remedial Design/Remedial Action**

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Prepared for

Spokane County
Utilities Department

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPjP) establishes the quality assurance (QA) objectives for Phase I of the Colbert Landfill Remedial Design/Remedial Action (RD/RA) project, and the QA organization and procedures developed to meet project objectives. Guidance used for preparation of this QAPjP is contained in various U.S. Environmental Protection Agency (EPA) documents, including The Quality Assurance Manual for Waste Management Branch Investigations, Region X (EPA 1986c) and A Compendium of Superfund Field Operations Methods (EPA/540/ P-87/001) (EPA 1987a).

The Data Quality Objectives (DQOs) established for this project reflect the intended use of project data and, as such, prescribe the level of quality, accuracy, precision, completeness, comparability, and representativeness of data to be collected and analyzed.

This QAPjP has been prepared by Landau Associates, Inc. (Landau), Spokane County's engineering consultant for design of the Colbert Landfill remedial action. Landau will implement this plan for all site activities accomplished as part of the remedial design (and preliminary remedial action) and will revise this document (if appropriate) prior to construction of the final remedial action.

1.1 PROJECT DESCRIPTION

The Colbert Landfill is located approximately 15 miles north-northeast of Spokane, Washington. The 40-acre landfill was operated from 1968 through 1986, and accepted both municipal and

commercial wastes. The landfill is now filled to capacity and is no longer receiving waste.

During the period from 1985 to 1980, a local electronics firm and a nearby military facility used the Colbert Landfill to dispose of spent organic solvents, mainly methylene chloride (MC) and 1,1,1-trichloroethane (TCA), at an average rate of several hundred gallons per month. In 1980, concern over these disposal practices led to the analysis of ground water samples collected from nearby private wells. The results indicate that some of the wells are contaminated with TCA. Other organic solvents have also been detected in the ground water near the landfill, including: trichlorethylene (TCE), tetrachloroethylene (PCE), 1,1-dichloroethylene (DCE), and 1,1-dichloroethane (DCA). These six chlorinated volatile organics are referred to as the "constituents of concern."

Beginning in 1980, several studies were conducted to determine the nature and extent of ground water contamination emanating from the Colbert Landfill. These studies have identified a contaminant plume moving to the south in an upper sand and gravel aquifer, and another plume moving predominantly to the west in a lower aquifer. Both aquifers are used as sources of drinking water for many residents in the vicinity of the site; however, many of these residents are now receiving drinking water from other sources.

A Remedial Investigation and Feasibility Study (RI/FS) were conducted in 1985 and 1986, respectively, and final reports were released for public comment in May 1987 (Golder and EnviroSphere 1987). The Record of Decision (ROD) for the interim final remedial action was released for public comment in September 1987 (EPA

1987b), and contains detailed information on the site and the selected remedial action. The selected remedial action, or cleanup alternative, will intercept the advance of the contaminant plumes by extracting contaminated ground water and then treating it to remove the organic solvents.

Subsequent to implementation of the ROD, a Consent Decree (U.S. District Court 1989) was negotiated between the regulatory authorities (EPA and Washington State Department of Ecology [Ecology]), Spokane County (County), and the Key Tronic Corporation. By this action, the County agreed to conduct the EPA-selected remedy at the site in accordance with the 1980 Comprehensive Environmental Response Compensation and Liability Act (CERCLA) requirements (as amended by the Superfund Amendments and Reauthorization Act, 1986) and the Washington State Hazardous Waste Cleanup Act, codified as 70.105B RCW.

As specified in the Scope of Work, RD/RA activities for implementing the selected cleanup alternative will include two phases. The purpose of Phase I is to obtain additional site characterization information to better define the hydrogeology and contamination distribution in proximity to the proposed extraction systems, and to initiate remedial action. Phase II will include the design, construction, and operation of the Final Remedial Action.

More specifically, Phase I activities will include: 1) the installation of 11 to 19 ground water monitoring wells (or well clusters), 2) the installation of four pilot extraction wells, 3) the collection of ground water samples from these wells for laboratory analysis, 4) the construction of pilot treatment and discharge facilities, and 5) pumping tests and ground water

treatability studies. Data and analysis from Phase I will be used to design the Phase II (Final) Remedial Action.

In accordance with the Scope of Work, chemical analyses will focus on the six constituents of concern: TCA, DCE, DCA, TCE, PCE, and MC. Other parameters specified in the Scope of Work, temperature, pH, conductivity, hardness, iron, and manganese, will be used during treatment system design activities. Additional chemical and physical analyses, described in the QAPjP, will be performed to further the project objectives described below.

1.2 PROJECT OBJECTIVES

The objectives of the Colbert Landfill RD/RA are to: 1) further characterize the hydrogeology and extent of contamination in the vicinity of the site; 2) implement the pilot extraction and treatability studies, and evaluate the results of these pilot study data to provide the design parameters for the Phase II (Final) Remedial Action program; and 3) design, construct, and operate the final ground water extraction, treatment and discharge systems. However, this QAPjP is intended to address Phase I activities (objectives 1 and 2) and will be modified prior to construction of the Phase II (Final) Remedial Action.

1.3 PROJECT DATA QUALITY OBJECTIVES

Laboratory data generated during this project will provide the basis for accomplishing the project objectives listed in Section 1.2. Data Quality Objectives (DQOs) for each of the Phase I goals (Project Objectives 1 and 2 above) are discussed below.

- o Project Objective 1: Additional physical and chemical data are needed to better characterize the hydrogeology and extent of contamination at the Colbert Landfill site to properly locate and design the Phase I pilot extraction and treatment systems. These data will be obtained by installing additional monitoring wells to supplement those installed during the Remedial Investigation, collecting geologic information during installation of these wells, and collecting (and analyzing) ground water samples from these new monitoring wells and selected existing monitoring wells.

DQOs for Project Objective 1 are to obtain data of sufficient quality for site characterization. The data users are Landau, EPA, and Ecology. Data generated across the site must be comparable to each other and have sufficient accuracy and precision to determine general trends in the extent of contamination. Inaccurate or incomplete data could result in improper location of pilot extraction wells, improper design (and potentially inadequate performance) of the pilot treatment facility, and possibly improper design of the Phase II (Final) Remedial Action.

- o Project Objective 2: Hydrogeologic, ground water treatability, and air quality data will be generated during Phase I pilot studies and will form the basis for design of the Phase II (Final) Remedial Action. Pumping tests will be accomplished to provide the hydrogeologic data needed to design the Phase II extraction systems, pipelines, and treatments system(s) (pumping test procedures will be described in the Phase I Pilot Well Plan). Ground water treatability studies will include operation and monitoring of pilot treatment facilities; the resulting data will be used to verify that Phase I effluent water quality criteria are met, and to design the Phase II treatment system (treatability study procedures will be described in the Phase I Treatment and Discharge Plan). Air quality monitoring data are needed to assess the health risks associated with air emissions from the Phase II (air stripping) treatment system, and to evaluate the need for off-gas treatment (air monitoring procedures are described in the Field Sampling Plan, Appendix QA-A, and will be further developed based on the data obtained during the early stages of Phase I).

The DQOs for Project Objective 2 are to obtain data of sufficient quality for engineering design, risk assessment, and compliance monitoring of treatment system effluent during Phase I. The data users are Landau, EPA, and Ecology. Data quality must be of sufficient accuracy and precision to: 1) develop engineering parameters for design of the Phase II interception, treatment and discharge system; 2) provide a high degree of confidence that effluent from the pilot treatment facility meets applicable water quality criteria; and 3) provide air monitoring data appropriate for risk assessment. Inaccurate or incomplete data could result in the

exceedance of Phase I effluent water quality criteria, erroneous evaluation of pilot study data, the improper design of Phase II (Final) Remedial Action components, and erroneous evaluation of the health risks associated with Phase II stripping tower air emissions.

- o Project Objective 3: Project Objective 3 addresses construction and operation of the Phase II (Final) Remedial Action, which is beyond the scope of this QAPjP. Consequently the DQOs for this objective will be addressed when the QAPjP is modified prior to construction of the Phase II system.

Both Objectives 1 and 2 can be achieved using data of analytical level III; that is, data from analyte-specific, non-CLP procedures, as described in EPA (1987e). Level III is consistent with the Consent Decree Scope of Work as well. Rigorous attention will be paid to QA/QC, such that analytical data will be of known high quality.

The QA procedures presented in this document are developed to assure that DQOs described above are met, as well as to assure that data generated are representative of actual conditions at the site. The overall goal of the project QA program is:

- o To assure a reasonable degree of confidence in project data and results through the establishment of a rigorous system of quality and performance checks on data collection, analysis, and reporting activities as well as appropriate and timely corrective action to ensure compliance with established performance and quality criteria.

To accomplish this goal, the following QA project objectives have been established:

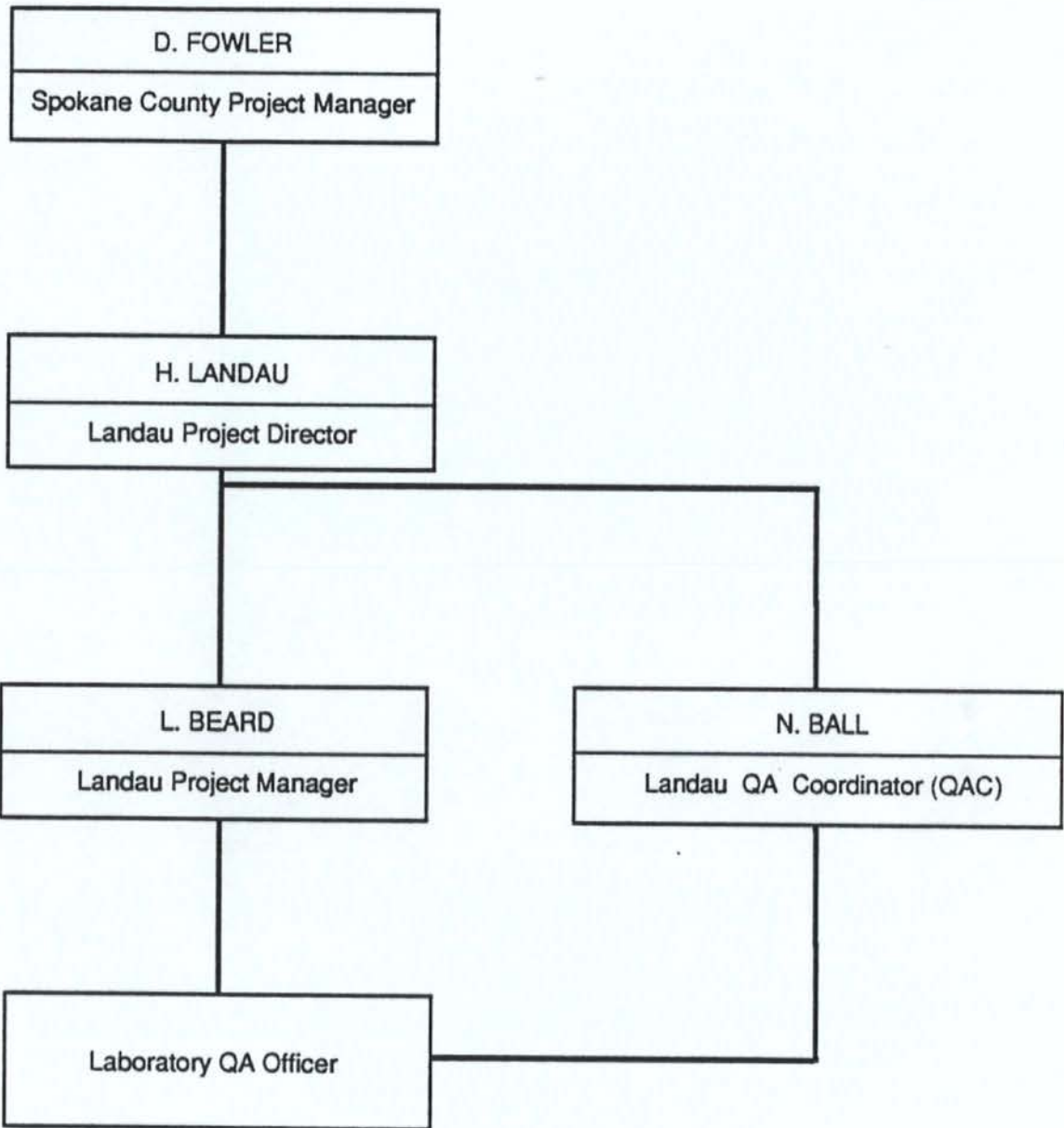
- o To establish, with the complete support of project management, a project QA function that is sufficiently independent of project technical activities to assure appropriate levels of review and surveillance of project activities and data;
- o To establish and define the duties and responsibilities of personnel involved in QA activities;
- o To establish effective systems for project documentation to assure proper development, use, and review of the data; and

- o To establish QA procedures that provide for sufficient objective evidence to verify that laboratory, field sampling, and other technical activities are performed in accordance with established technical procedures and requirements.

This QAPjP presents the procedures and methods for sampling and sample handling, sample chain-of-custody, instrument/equipment calibration, chemical analysis, internal quality control, auditing, and data assessment developed to meet project and QA objectives.

2.0 PROJECT QUALITY ASSURANCE ORGANIZATION AND RESPONSIBILITIES

The project QA organization, showing individuals with QA responsibility and lines of QA authority, is shown on Figure QA-2.1. Specific project Quality Assurance responsibilities are listed by responsible individuals in Table QA-2.1.



QUALITY ASSURANCE RESPONSIBILITIES

Responsibilities

Provide technical project direction and coordinate project-agency interaction; review project QA needs and approve appropriate QA corrective actions as needed.

Oversee technical project team performance to ensure successful accomplishment of technical and QA project objectives.

Provide technical QA assistance; direct implementation of QAPjP; arrange contract or other external procurement packages for QA needs; prepare corrective action response; prepare and submit QA reports to project management; and conduct or supervise laboratory and field audits.

Ensure that all laboratory QA objectives are met and laboratory QA/QC information is properly documented and reported.

3.0 DATA QUALITY OBJECTIVES FOR PARCC PARAMETERS

The purpose of this section is to describe DQOs for precision, accuracy, representativeness, completeness, and comparability (PARCC) of project data. Specific procedures to be used for sampling, chain of custody, calibration, laboratory analysis, reporting, internal quality control, audits, preventative maintenance, and corrective action are described in other sections of this QAPjP. Detection limits are discussed in Section 7.0.

Samples will be analyzed in accordance with accepted analytical procedures. These procedures were selected from published EPA or NIOSH methods contained in the following documents: SW-846 Test Methods for Evaluating Solid Waste, Third Edition (EPA 1986a), Standard Methods for the Examination of Water and Wastewater (APHA-AWWA-WPCF 1985), and the Manual of Analytical Methods (NIOSH 1988).

3.1 PRECISION AND ACCURACY

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed conditions. It is expressed as a standard deviation or relative percent difference. Accuracy is the degree of agreement of a measurement (or an average of measurements of the same property), X , with an accepted reference or true value, T . Accuracy can be expressed as the difference between the two values ($X-T$), the difference as a percentage of the reference or true value ($100 (X-T)/T$), or as a ratio (X/T). Accuracy is a measure of the bias in a system and will be expressed as the percent recovery of spiked samples.

Accuracy and precision are determined through quality control parameters such as surrogate recoveries, matrix spikes, matrix spike duplicates, quality control (QC) check samples, and blind field duplicates. The project data quality objectives for the evaluation of these parameters are based on those given in the EPA or NIOSH method or on functional guidelines outlined by the EPA for evaluating inorganic and organic analyses (EPA 1988a, 1988b). QC objectives (control limits expressed as percent) for surrogate recoveries, and percent recovery and relative percent difference (RPD) for matrix spikes and matrix spike duplicates for this project are listed in Tables QA-3.1 and QA-3.2. Control limits listed in these tables are consistent with EPA and NIOSH guidelines contained in the specific methods. These control limits will be used as criteria for data acceptance. If the required quality control limit for replication or recovery is not met, corrective action will be performed by the laboratory following the guidelines presented in Section 13. If the corrective action is performed and QC objectives still are not met, the Landau QA Coordinator (QAC) will be notified by the laboratory prior to data submittal, so that additional corrective action can be taken, if appropriate. Such action may include reanalysis of the sample or other determination to be made by the Landau QAC and the Landau Project Manager.

In addition to spikes and matrix spike duplicates, QC samples for verification of precision and accuracy include QC check samples and blind field duplicates (Section 9.1). Acceptance criteria for

TABLE QA-3.1

SURROGATE RECOVERY CONTROL LIMITS

Surrogate Name	Control Limits (percent)
=====	
VOAs by GC	

Matrix: Water	
bromochloromethane	68-120
bromofluorobenzene	68-120

TABLE QA-3.2

LABORATORY MATRIX SPIKE/MATRIX SPIKE DUPLICATE CONTROL LIMITS

Control Limits		
	Recovery (percent)	RPD(a) (percent)
=====		
VOAs by GC		

Matrix: Water		
1,1-Dichloroethylene	61-145	20
Trichloroethylene	69-123	20

Matrix: Air	NA(c)	20
=====		
Metals		

Matrix: Water		
Iron	67-125	20
Manganese	75-125	20
=====		
Anions		

Matrix: Water		
Chloride	71-133	20
Sulfate	60-129	20
Nitrate/Nitrite	53-125	20
=====		
Other		

Matrix: Water		
Total Dissolved Solids	NA(c)	20(b)
Chemical Oxygen Demand	NA(c)	20(b)
Hardness	NA(c)	20
Total Organic Carbon	69-135	20
Total Organic Halides	66-124	20

(a) RPD = Relative Percent Difference.

(b) If concentration <100 mg/L, then RPD is ± 10 mg/L.

(c) Replicate samples are substituted for MS/MSD.

volatile organics QC check samples are given in Method 8010. If sample concentration is greater than five times the project's Contract Required Detection Limit (CRDL), quality control objectives for blind field duplicates will be a Relative Percent Difference (RPD) of ± 20 percent for inorganic or organic analysis of water. If the sample concentration is less than five times the project's CRDL, then the acceptance criteria will be \pm CRDL.

If results for the QC check samples or blind field duplicates are outside the control limits, corrective action and/or data qualification requirements will be determined on a case-by-case basis by the Landau QAC. The matrix of the QC check samples may not match the field sample matrix and blind field duplication can be poor due to sample inhomogeneity. Therefore, corrective action will be determined by the Landau QAC and discussed in the data QA report.

3.2 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Sample locations and field sampling procedures have been chosen to maximize representativeness. The degree of representativeness will be measured by repetitive measurements of the same parameter at the same sampling location over several distinct sampling events. The potential effect of seasonal variations and sampling on accuracy will also be considered with respect to representativeness.

3.3 COMPLETENESS

Completeness is a measure of the proportion of data specified in the sampling plan which is determined to be valid. The QA objective for completeness during this project will be 90 percent.

3.4 COMPARABILITY

Comparability is an expression of the confidence with which one data set can be compared to another. All measurements will be made so that results are consistent and representative of the media and conditions measured. All data will be calculated, qualified, and reported in units consistent with EPA guidelines. Method detection limits and units to be reported are described in Section 7.0 of this document.

4.0 SAMPLING PROCEDURES AND HANDLING

4.1 SAMPLING SITE SELECTION

Ground water sampling locations were selected based on either their proximity to known or suspected contaminant plumes, or their representativeness in characterizing site hydrogeology. In addition to ground water samples, an air sampling network, consisting of a minimum of three sampling stations, will be placed near the pilot stripping tower during Phase I-East System pilot studies to monitor volatile organics emissions. One station will be upwind and will provide the background sample. The other two stations will be downwind of the stripping tower. The sampling station orientations will be based on available wind rose data for the season of operation.

Specific details of the air sampling network will be determined after local weather patterns have been established and the mass loading to the pilot stripping tower has been estimated using chemical results from Phase I monitoring wells. This information will impact the flow rate, collection time, and locations for the air samples. After this additional information has been collected and evaluated, specific air sampling network information will be developed and submitted to EPA and Ecology before implementation.

4.2 SAMPLING PROCEDURES

Sampling procedures for each matrix group are presented in the Field Sampling Plan (Appendix QA-A). Table QA-4.1 presents matrix group, sample bottle identification code, sample chemical analyses, sample containers to be used, sample preservation methods, and maximum holding times.

TABLE QA-4.1

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Bottle(a) Code	Analyses	Sample Container	Preservation	Holding(b) Time
Ground Water	N	Sulfate	16 oz. plastic	Cool, 4 C	28 days
		Chloride			28 days
		Total Dissolved Solids			7 days
	A	Nitrate/Nitrite Hardness	8 oz. plastic	Cool, 4 C H SO to pH < 2	14 days 6 months
	S	Chemical Oxygen Demand	16 oz. glass	Cool, 4 C H SO to pH < 2	28 days
	O	Total Organic Carbon	100 mL glass Teflon-lined septum cap (leave no headspace)	Cool, 4 C H SO to pH < 2	28 days
	V	Volatiles	2 ea - 40 mL glass vials (leave no headspace) Teflon-lined septum cap	Cool, 4 C	14 days
	M	Metals (Fe,Mn)	16 oz. plastic	HNO to pH < 2	6 months
Air	X	Total Organic Halides	250 mL amber glass Teflon-lined septum cap	Cool, 4 C H SO to pH < 2	14 days
	T	Volatile Organics	Charcoal tube	Cool, 4 C	7 days

(a) Bottle code to follow sample station number.

(b) Holding times are from date of collection. All samples will be shipped to the laboratory within 24 hours (except as noted for samples collected on Friday).

4.3 CHAIN-OF-CUSTODY PROCEDURES

Sample control and chain-of-custody procedures are addressed in Section 5.0.

4.4 SAMPLE DOCUMENTATION

Sample documentation will comply with procedures contained in Section 4.6 of A Compendium of Superfund Field Operations Methods (EPA 1987a). Project sampling and sample handling will be documented through the use of the records summarized in Table QA-4.2. Examples of the forms to be used for sampling activities are presented in Appendix QA-B.

4.5 LABORATORY COORDINATION AND REPORTING

The analytical laboratory will perform chemical analysis of air and ground water samples. The Landau Field Representative will coordinate sampling activity with the laboratory to assure that all samples can be processed within the required holding times. (Actual holding times will be verified by review during data validation as described in Section 8.0).

TABLE QA-4.2
SAMPLING AND SAMPLE HANDLING RECORDS

RECORD	USE	RESPONSIBILITY/ REQUIREMENTS
Field Log Book	Record significant events, observations and measurements.	Maintained by Landau Field Representative; must be bound; all entries factual, detailed, and objective; entries must be signed and dated.
Sample Collection Form	Provide a record of each sample collected (Appendix QA-B)	Completed, dated, and signed by Landau Field Representative; maintained in project file.
Log of Exploration Form	Record geologic and ground water table data during field explorations; used to develop final logs of borings and well logs (Appendix QA-B).	Completed by Landau Field Representative; maintained in project file.
Sample Label	Accompanies sample; contains specific sample identification information.	Attached to sample container by analytical laboratory and completed by sampler.
Chain-of-Custody Record	Seals sample shipment container to prevent tampering or sample transference. (Appendix QA-B)	Completed, signed, and applied by sampler at time samples are transported.
Sample Analysis Request Packing List	Provides a record of each sample number, date of collection/transport, sample matrix, analytical parameters for which samples are to be analyzed, and condition of samples on receipt at laboratory (Appendix QA-B).	Completed by sampler at time of sampling transport; carbonless copies distributed to laboratory (2) and Landau project file (1).

5.0 SAMPLE CUSTODY

Strict chain-of-custody procedures will be followed on this project to maximize sample integrity and accountability. Sample control and chain of custody in the field and during transport to the laboratory will be conducted in accordance with procedures described in Section 4 of A Compendium of Superfund Field Operations Methods (EPA 1987a) and Sections FS-4.1.10, FS-4.2.3, and FS-4.3.4 of Appendix QA-A. Sample control and custody at the laboratory through sample disposal will be conducted in accordance with procedures contained in Section F of the CLP SOWs for organics (EPA 1986b) and inorganics (EPA 1987c) analysis.

A chain-of-custody form similar to that presented in Appendix QA-B will be used for this project. When samples are transferred, the person relinquishing the samples will sign the Chain-of-Custody Form and record the date and time of transfer. The sample collector will sign the form in the first signature space.

Project documentation of sample custody will be verified by the Landau QAC during regular review of the data validation package. Data validation is discussed further in Section 8.0.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 LABORATORY INSTRUMENTS

Laboratory instruments will be calibrated and their performance evaluated in accordance with procedures in the EPA or NIOSH method cited. Instrument performance will be evaluated against appropriate check standards and calibration blanks for each parameter prior to commencing actual analysis on each day the analysis is performed. Divergence from benchmark criteria (as defined in the above methods) will be corrected prior to analysis.

For volatile organics analysis in water, the gas chromatograph (GC) will be calibrated initially for each analyte using a 5-point calibration using concentrations established according to guidelines in the method. Linearity must be established by a variation of less than 20 percent Relative Standard Deviation (RSD) in the calibration factor throughout the working range. The calibration will be verified each day using one or more calibration standards, and must vary less than 15 percent from the initial calibration. Continuing calibration will be performed throughout the day using a mid-level standard and will vary less than 15 percent from the initial calibration factors. Retention time windows will be established for each analyte according to Method 8010. These retention time windows will be updated daily according to the method and all continuing standards must fall within the windows. For volatile organics analysis in air, the GC will be calibrated daily using a 5-point calibration.

After calibration and standardization of instrumentation are within acceptable limits, precision and accuracy will be evaluated by analyzing a QC check sample for each analysis performed that

day. QC check samples containing all analytes of interest will be either purchased commercially or prepared from pure standard materials independently from calibration standards. The QC check sample will be analyzed and evaluated according to criteria in the method. Instrument performance check standards and calibration blank results will be recorded in a laboratory log book, which will also contain evaluation parameters, benchmark criteria, and maintenance information (see Section 11.0). Table QA-6.1 presents suggested QC check materials for laboratory analysis and for field equipment measurement parameters not addressed in the methods cited above.

6.2 FIELD INSTRUMENTS

Seven field instruments (photoionization detector, combustible gas indicator, pH meter, conductivity meter, thermometer, water level indicator, and air sampling pumps) will be used during this project. The field meters will be calibrated (if applicable) in accordance with manufacturer's instructions, which are presented in Appendix QA-C. The air sampling pump will be calibrated with a sorbent tube in-line. QC limits for accuracy and precision of the field analyses are listed in Table QA-6.2. The water level indicator probe will be compared periodically to a steel measuring tape.

Calibration results will be recorded in an instrument log book dedicated to each field instrument. This log book also will contain instrument preventive maintenance information, as appropriate.

TABLE QA-6.1
INSTRUMENT PERFORMANCE CHECK
MATERIALS AND FREQUENCY

Parameter	Check Material ^(a)	Frequency
<u>Laboratory Analysis</u>		
Chemical Oxygen Demand	NA	
Total Dissolved Solids	NA	
Total Organic Carbon	5 mg/L Standard Solution	Daily or every 15 samples ^(b)
Total Organic Halides	100 ug/L Standard Solution	Daily or every 15 samples ^(b)
Sulfate	20 mg/L Standard Solution	Daily or every 20 samples ^(b)
Chloride	EPA WP Reference Solution	Daily or every 20 samples ^(b)
Nitrate	50 ug/L Standard Solution	Daily or every 20 samples ^(b)
Hardness	Commercially prepared standard solution	Daily or every 20 samples ^(b)
<u>Field Measurement</u>		
Photoionization Detector	100 ppm Isobutylene	Before each day's use
Combustible Gas Indicator	50% LEL ^(c) Pentane	Daily
pH (meter)	pH 4,7,10 Standard Buffer Solution	Minimum of every 4 hours of field use
Conductivity	0.01N KCl Standard Solution	Minimum of every 4 hours of field use
Temperature	National Bureau of Standards Thermometer	Minimum of every 6 months

(a) Check materials are subject to change based on actual preliminary instrument qualifying results.

(b) Whichever is greater; daily is defined as every day the analysis is performed.

(c) LEL = Lower Explosion Limit.

TABLE QA-6.2

FIELD ANALYSES
QUALITY CONTROL LIMITS

Parameter	Units	Accuracy	Precision
=====			
pH unit	Standard pH units	± 0.1 pH unit	± 0.1 pH
Specific Conductance	umhos/cm	$\pm 5\%$	$\pm 5\%$
Temperature	degrees C	$\pm 0.1^{\circ}\text{C}$	$\pm 0.1^{\circ}\text{C}$
Water Level Indicator	inches	± 0.01 inch	± 0.01 inch
Photoionization Detector	parts per million	$\pm 5\%$	$\pm 5\%$
Combustible Gas Indicator	% Lower Explosion Limit	$\pm 7\%$	$\pm 7\%$
Air Sampling Pump	liters per minute	$\pm 5\%$	$\pm 5\%$

7.0 ANALYTICAL PROCEDURES

The EPA and NIOSH methods have established detection limits (and, in some cases, quantification limits) covering each analyzed constituent for use nationwide as a contractual requirement for analytical laboratories. Quantification limits were established after considering typical ranges of interferences affecting quantification of constituents in representative environmental samples. Quantification of constituents at levels below the established quantification limits may be achieved if interferences are not significant. For highly contaminated samples, matrix effects may result in higher quantification limits being necessary.

General methods and method quantification limits for analyses to be performed are summarized in Table QA-7.1 and QA-7.2. Methods for analysis will include analytical procedures commonly employed by the project laboratory and verified as to accuracy and precision. QC checks and decision criteria for determining if an analysis is within quality control requirements will follow the guidelines given in the method.

Where appropriate and consistent with anticipated data uses and with recognition of the validation requirements, these procedures may be modified to incorporate techniques familiar to the project laboratory with agreement from the Landau QAC. Deviations from EPA or NIOSH methods must be substantiated by full data verification and validation procedures according to requirements presented in the EPA 530 SW-87-008 Test Method Equivalency Petitions manual (EPA 1987d). Any such procedure deviations deemed significant by the Landau QAC will be submitted to the EPA and Ecology for review and concurrence prior to implementation.

TABLE QA-7.1
METHODS AND QUANTIFICATION LIMITS FOR
ANALYSIS OF GROUND WATER

Analyte	Technique	Analysis Method	Quantification Limit
=====			
Organic Priority Pollutants			
Volatile Organics	GC/HSD	SW 8010(a)	
Constituents of Concern			
1,1,1-Trichloroethane			0.3 ug/L
1,1-Dichloroethylene			1.3 ug/L
1,1-Dichloroethane			0.7 ug/L
Trichloroethylene			1.2 ug/L
Tetrachloroethylene			0.3 ug/L
Methylene Chloride			<2.5 ug/L
Other Volatile Organics			
Benzyl chloride			(b)
Bis (2-chloroethoxy)methane			(c)
Bromobenzene			(d)
Bromodichloromethane			1.0 ug/L
Bromoform			2.0 ug/L
Bromomethane			(d)
Carbon tetrachloride			1.2 ug/L
Chlorobenzene			2.5 ug/L
Chloroethane			5.2 ug/L
2-Chloroethyl vinyl ether			1.3 ug/L
Chloroform			0.5 ug/L
1-Chlorohexane			(d)
Chloromethane			0.8 ug/L
Chloromethylmethyl ether			(c)
Chlorotoluene			(d)
Dibromochloromethane			0.9 ug/L
Dibromomethane			(d)
1,2-Dichlorobenzene			1.5 ug/L
1,3-Dichlorobenzene			3.2 ug/L
1,4-Dichlorobenzene			2.4 ug/L
Dichlorodifluoromethane			(b)
1,2-Dichloroethane			0.3 ug/L
trans-1,2-Dichloroethylene			1.0 ug/L
1,2-Dichloropropane			0.4 ug/L
trans-1,3-Dichloropropylene			3.4 ug/L
1,1,2,2-Tetrachloroethane			0.3 ug/L
1,1,1,2-Tetrachloroethane			(d)
1,1,2-Trichloroethane			0.2 ug/L
Trichlorofluoromethane			(d)
Trichloropropane			(d)
Vinyl chloride			1.8 ug/L
Other Organic Constituents			
Total Organic Carbon	IR	SW 9060	1.0 mg/L
Total Organic Halides	Coulometric	SW 9020	50 ug/L

TABLE QA-7.1 (continued)
METHODS AND QUANTIFICATION LIMITS FOR
ANALYSIS OF GROUND WATER

Analyte	Technique	Analysis Method	Quantification Limit
=====			
Inorganic Constituents			
Iron	ICP	SW 6010	5.0 ug/L(e)
Manganese	ICP	SW 6010	20 ug/L(e)
Nitrate/Nitrite	IC	EP 300 (f)	100 ug/L
Chloride	IC	EP 300 (f)	1 mg/L
Sulfate	IC	EP 300 (f)	1 mg/L
Chem. Oxygen Demand	HACH	EP 410.4(g)	10 mg/L
Total Dissolved Solids	Gravimetric	EP 160.1(g)	10 mg/L
Hardness	Titrimetric	EP 130.2(g)	1 mg/L
Field Parameters			
pH	Electrometric	SW 9040	0.1 pH unit
Conductivity	Specific Conductance	SW 9050	1 umho/cm
Temperature	Thermometric	EP 170.1(h)	0.2 C.

-
- (a) SW = Test Methods for Evaluating Solid Waste (SW-846), 3rd edition, EPA 1986.
 - (b) Demonstrated erratic results when tested by purge-and-trap.
 - (c) Demonstrated poor purging efficiency.
 - (d) Quantification limit not listed in Method 8010.
 - (e) If standard detection QC does not conform to CLP calibration verification requirements, AA methods will be used.
 - (f) EP = Methods for Chemical Analysis of Water and Wastes, EPA Addendum 3/84.
 - (g) EP = Methods for Chemical Analysis of Water and Wastes, EPA 1983.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

All analyses performed for this project must be accompanied by sufficient QC results to enable reviewers to conclusively determine the quality of the data. The Landau QAC or designee is responsible to the Landau Project Director for conducting checks for internal consistency, transmittal errors, laboratory protocols, and for complete adherence to the QC elements specified in this QAPjP.

Field measurements (photoionization detector, combustible gas indicator, ground water level, pH, conductivity, and temperature) will be verified and checked through review of measurement and recording procedures during surveillance of field and instrumentation calibration procedures. Transfer of field data from field notebooks to raw data lists will be verified by the Landau QAC.

Analytical data will be reported in the units specified in Tables QA-7.1 and QA-7.2. These units have been selected to assure ease of comparison with previously generated relevant site data and human health criteria.

The laboratory will provide documentation including the sample results with appropriate annotations, and all QA/QC results associated with that sample set (blanks, laboratory duplicates, matrix spikes, matrix spike duplicates, laboratory control samples, and surrogate recoveries). Raw data will not be required for all samples; however, the laboratory will maintain this information in their files. In addition, complete data validation of the raw data, initial and continuing calibrations, and other QC data will be performed on 5 to 10 samples selected by the Landau QAC. Data

validation procedures for all other samples will include checking the following:

- o Holding times,
- o Field trip blanks,
- o Field rinsate blanks,
- o Field transfer blanks,
- o Blind field duplicates,
- o Laboratory matrix spikes,
- o Laboratory matrix spike duplicates,
- o Method blanks,
- o QC check samples,
- o Surrogate recoveries,
- o Detection limits,
- o Assessment of precision,
- o Assessment of accuracy, and
- o Assessment of completeness.

Section 12.0 presents statistical tests used to determine data precision, accuracy, and completeness. If precision or accuracy fall outside of established acceptance limits, re-analysis or corrective action will be implemented as appropriate. All corrective action will be substantial and defensible, or the corrected data will not be used. Corrective action procedures are presented in Section 13.0.

9.0 INTERNAL QUALITY CONTROL

QC checks will consist of measurements performed in the field and laboratory. Analytical procedures referenced in Section 7.0 specify routine methods required to evaluate whether data are within proper QC limits. Additional QC checks include analysis of a number of field and laboratory QC samples, which are described in the following subsections.

9.1 FIELD/INTRALABORATORY METHODS

The following QC samples will be evaluated to verify accuracy and precision of analytical results for this investigation. The frequency of laboratory and field QC analysis is described herein. The frequency of QC sample collection is specified on a percentage basis because the total number of samples collected during Phase I of this project is dependent on site conditions (hydrogeology and contaminant distribution) that cannot be determined until the initial Phase I monitoring wells have been constructed and the initial analytical results evaluated.

9.1.1 Field Trip Blank

The field trip blanks for ground water sampling will consist of a deionized (DI)/ distilled water blank (supplied by the analytical laboratory), which will be transported to and from the field, then returned to the laboratory unopened and unaltered for volatile organics analysis to determine possible container contamination. A minimum of 5 percent of the total number of ground water samples will be sent to the laboratory as field trip blanks. Field trip blanks for air analysis will consist of sorbent tubes taken to the

field, returned unopened to the laboratory, and analyzed at a rate of 1 blank per weekly shipment of sorbent tubes shipped to and from the site.

9.1.2 Field Rinsate Blank

Field rinsate blanks will consist of DI/distilled water (supplied by the analytical laboratory) passed over and/or through decontaminated sampling equipment. Surfaces and materials exposed during actual sampling will be rinsed to evaluate the effectiveness of sampling equipment decontamination procedures and potential for equipment or field cross contamination. A minimum of 5 percent of the total number of ground water samples analyzed for volatile organics, hardness, iron, manganese, and landfill leachate parameters will be collected as rinsate blanks. Field rinsate blanks will not be collected as part of air sampling QC procedures.

9.1.3 Field Transfer Blank

The field transfer blank will consist of DI/distilled water (supplied by the analytical laboratory) transferred to the appropriate sampling containers in the field to determine possible sample contamination from the field. A minimum of 5 percent of the total number of ground water samples collected for volatile organics analysis will be collected as field transfer blanks. Field transfer blanks will not be collected as part of air sampling QC procedures.

9.1.4 Blind Field Duplicate

The field duplicate for ground water sampling will consist of two water samples collected sequentially. Samples will be coded such that the laboratory cannot discern from the sample label which samples are duplicates. Field duplicate samples will be collected at a rate of 5 percent of the total number of samples collected for volatile organics analysis, and 10 percent of the total number of samples collected for treatment system design purposes (hardness, iron, manganese) and for landfill leachate parameters. Duplicate air samples for volatile organics analysis will consist of a second sample (upwind or downwind of the treatment system) collected concurrently with the original sample. A minimum of 5 percent of all air samples collected will be blind field duplicate samples.

9.1.5 Laboratory Matrix Spike

For ground water samples, a minimum of one laboratory matrix spike will be analyzed per 20 samples (or one per sampling event, if fewer than 20 samples are obtained) for chlorinated volatile organics and metals. A minimum of one laboratory matrix spike will be analyzed per every ten samples for total organic carbon, total organic halides, sulfate, nitrate/nitrite, and chloride. These analyses will be performed to provide information on accuracy and assure that extraction and concentration levels are acceptable. The laboratory matrix spike will follow EPA matrix spike guidelines specified in the EPA Method. Spiked air samples will follow guidelines specified in the NIOSH methods.

9.1.6 Laboratory Matrix Spike Duplicate

For ground water samples, a minimum of one laboratory matrix spike duplicate will be analyzed per 20 samples (or one per sampling event if fewer than 20 samples are obtained) for chlorinated volatile organics and metals. A minimum of one laboratory matrix spike duplicate will be analyzed per ten samples for total organic carbon, total organic halides, sulfate, nitrate/nitrite, and chloride. These analyses will be performed to provide information on the precision of chemical analysis. The laboratory duplicate matrix spike will follow EPA duplicate matrix spike guidelines specified in the EPA methods. Spiked air samples will follow guidelines specified in the NIOSH methods.

9.1.7 Laboratory Method Blank

A minimum of one laboratory method blank will be analyzed for all parameters per 20 samples, one every 12 hours, or one per batch of samples analyzed (if fewer than 20 samples are analyzed) to assess possible laboratory contamination. Dilution water will be used whenever possible. Method blanks will contain all reagents used for analysis.

9.1.8 QC Check Sample

For ground water samples, a minimum of one QC check sample containing each analyte of interest will be analyzed per 20 samples (or per 15 for TOX and TOC) or one per sampling event (if fewer than 20 samples are obtained) to verify accuracy of laboratory equipment. Analysis will follow guidelines established in the EPA

method. Procedure calibrations will substitute for QC check samples for chemical oxygen demand and total dissolved solids.

For the air samples, three sorbent tubes at each of five concentrations, plus three media blanks, will be analyzed at least once for each batch of sorbent to determine desorption efficiency. Additional QC samples per batch will include three QC check samples spiked by the analyst and three provided to the analyst already spiked according to guidelines in the NIOSH methods.

9.2 INTERLABORATORY COMPARISONS

No interlaboratory comparisons will be required. Accuracy of the analyses will be evaluated based on the results of the blanks, matrix spikes, and QC check sample analyses. A limited number of samples may be split with EPA and/or Ecology, which will provide interlaboratory comparisons when analyzed.

10.0 PERFORMANCE AND SYSTEM AUDITS

This section presents the internal performance and systems audits required to monitor performance of the laboratory and field measurement systems. Performance and system audits of sampling activities and laboratory operations will consist of direct observations of work being performed, and inspection of laboratory and sampling equipment use, calibration, and maintenance to verify adherence to QA/QC requirements.

Internal audits of both field and laboratory activities will be conducted by the Landau QAC or designee in accordance with the frequency established in Table QA-10.1. Audits will be unannounced to assure representative performance of technical and QA procedures.

Checklists for both field and laboratory audits will be based on National Enforcement Investigation Center (NEIC, 1984) audit checklists as presented in Appendix E. The audit will be conducted only by individuals that have no direct responsibilities for the activities being audited.

Prior to internal audits, the auditor(s) will meet with the audited party to define the scope of the audit. The physical audit will consist of reviewing audited activities, completing the checklist, and noting any nonconformances, deficiencies, and relevant observations. An exit review will be conducted with the audited party to notify them of preliminary audit findings.

TABLE QA-10.1
SCHEDULE OF AUDIT ACTIVITIES

Activity	Frequency	Time Schedule	Auditor
Field Sampling ^(a)	Once	1st Quarter	Landau QAC
Laboratory Analysis ^(a)	Once	1st Quarter ^(b)	Landau QAC

(a) Audit to cover documentation, sample handling, and measurement procedures.

(b) Within first two weeks after sample submittal. Exact date of audit not announced to laboratory.

The auditor or designee will prepare an audit report that includes findings, nonconformances, observations, recommended corrective action, and a schedule for completion of such action. The Audit Report Format is presented in Table QA-10.2.

For each identified nonconformance, a Corrective Action Report (Figure QA-10.1) will be issued as part of the audit report by the auditor to notify the responsible party (the individual responsible for implementing corrective action) of the recommended corrective action and its schedule for completion (see Section 13.0). If a field corrective action is required, the Landau Field Coordinator will be notified. If a laboratory corrective action is required, the Laboratory QA Officer will be notified. The audit report will be distributed to the Landau Project Manager and Landau Project Director.

The audit will remain open until all corrective action is completed by the responsible party and approved by the Landau QAC. Once all findings are corrected and documented on Corrective Action Reports, the audit will be closed by the Landau QAC. Closure may be effected by either a memo to be filed with the audit report, or by another appropriate method. The audit reports and associated Corrective Action Reports will be submitted to Ecology and EPA once the audit is closed.

TABLE QA-10.2
AUDIT REPORT FORMAT

1. Purpose of Audit
2. Audit Basis
3. Time and Place of Audit
4. Personnel Contacted
5. Audit Team Members
6. Summary of Events
7. Findings and Recommendations
 - a. Positive Findings
 - b. Negative Findings
8. Required Follow-up (responsible parties, summary of required corrective action, date of reaudit, if required)
9. Distribution of Audit Report and Corrective Action Reports

LANDAU ASSOCIATES, INC.
CORRECTIVE ACTION REPORT

Sample Program Identification: _____

Sampling Dates: _____

Material to be Sampled: _____

Measurement Parameter: _____

Acceptable Data Range: _____

Corrective Actions Initiated By: _____

Title: _____ Date: _____

Problem Areas Requiring Corrective Action: _____

Measures to Correct Problems: _____

Means of Detecting Problems (field observations, systems audit, etc.) _____

Approval for Corrective Actions: _____

Title: _____ Date: _____

Signature: _____

LANDAU ASSOCIATES, INC.

Corrective Action Report

11.0 PREVENTIVE MAINTENANCE

11.1 FIELD INSTRUMENTS

The Landau Field Representative at each drill rig or each well site is responsible for field instrumentation preventive maintenance. Preventive maintenance on field instruments will be performed by qualified field technicians in accordance with manufacturer's instructions and maintenance schedules. Maintenance will be documented in instrument log books, and will include the date and initials of individual performing the maintenance.

The Landau Field Representative will routinely compare instrument calibration results against preventive maintenance records to verify the effectiveness of the preventive maintenance program. The Landau Field Representative is responsible for scheduling preventive maintenance required by the manufacturer.

11.2 LABORATORY INSTRUMENTS

The analytical laboratory manager has ultimate responsibility for maintaining laboratory instruments in good working order, including responsibilities for routine maintenance and the training of personnel in maintenance procedures. All maintenance activities and other appropriate details will be documented daily in maintenance log books by the laboratory personnel performing the maintenance. Each entry will be signed and dated. At a minimum, the preventative maintenance schedules contained in the EPA methods and in the equipment manufacturer's instructions will be followed.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA

Analytical data will be reviewed to assure that the QA/QC objectives for precision, accuracy, and completeness are met. These reviews are intended to identify the occurrence of deficiencies in time to take corrective action. This section describes routine procedures for assessing project data.

12.1 ASSESSMENT OF PRECISION

Precision measures the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. QA/QC sample types that test precision include field duplicates and matrix spike duplicates. The estimate of precision of duplicate measurements is expressed as a relative percent difference (RPD), and is calculated as follows:

$$RPD = \frac{D_1 - D_2}{(D_1 + D_2)/2} \times 100$$

Where D_1 = First sample value

D_2 = Second sample value (duplicate)

The RPDs will be routinely calculated and compared with DQOs.

To set control limits, the standard deviation, s , of a series of replicate measurement limits is calculated:

$$s = \sqrt{\sum_{i=1}^n \left[\frac{(X_i - \bar{X})^2}{n-1} \right]^{1/2}}$$

where: s = the sample standard deviation

n = the number of replicates

X_i = the i th replicate

\bar{X} = the mean of the replicates

12.2 ASSESSMENT OF ACCURACY

Accuracy is assessed using results of surrogate recoveries, QC check samples, and matrix spike analyses and is routinely expressed as a percent recovery, which is calculated:

$$\text{Percent Recovery} = \frac{(\text{Total Analyte Found} - \text{Analyte Originally Present}) \times 100}{\text{Analyte Added}}$$

The percent recovery will be routinely calculated and checked against data quality objectives.

12.3 ASSESSMENT OF COMPLETENESS

The amount of valid data produced will be compared with the total analyses performed to assess the percent of completeness. Completeness will be routinely calculated and compared with DQOs.

13.0 CORRECTIVE ACTIONS

Corrective actions may be needed for two categories of non-conformance:

- o Deviations from the methods or QA requirements established in the QAPjP, and
- o Equipment or analytical malfunctions.

Corrective action procedures that might be implemented based on audit results or detection of unacceptable data are developed on a case-by-case basis. Such actions may include one or more of the following:

- o Altering procedures in the field;
- o Using a different batch of containers;
- o Performing an additional audit of field or laboratory procedures;
- o Reanalyzing samples if holding times allow;
- o Resampling and analyzing;
- o Evaluating sampling and analytical procedures to determine possible causes of the discrepancies;
- o Accepting the data with no action, acknowledging the level of uncertainty; and
- o Rejecting the data as unusable.

During field operations and sampling procedures, the Landau Field Representative will be responsible for taking and reporting required corrective action. A description of any such action taken will be entered in the Field Log Book. If field conditions are such that conformance with the QAPjP is not possible, the Landau QAC will be consulted immediately. Any corrective action or field condition resulting in a major revision of the QAPjP or Field Sampling Plan will be communicated to the County Project Manager as well as EPA and Ecology for review and concurrence. This

communication will be made prior to changes in the field activities whenever possible.

During laboratory analysis, the Laboratory QA Officer will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet data quality goals outlined in this QAPjP, corrective action will follow the guidelines in the EPA methods and the EPA guidelines for data validation for organics and inorganics (EPA 1988a, 1988b). At a minimum, the laboratory QA officer will be responsible for monitoring the following:

- o Calibration check compounds must be within performance criteria specified in the EPA or NIOSH method or corrective action must be taken prior to initiation of sample analysis. For volatile organics analysis in water (Method 8010), a minimum of five calibration standards will be prepared for each analyte of interest. One of the standards should be at a concentration near, but above, the method quantification limit. The other concentrations should correspond to the expected range of concentrations found in real samples or should define the working range of the detector. The percent relative standard deviation cannot exceed 20 percent when comparing calibration factors to determine if the five-point calibration curve is linear. The working calibration curve or calibration factor must be verified on each working day by the injection of one or more calibration standards. If the response for any analyte varies from the predicted response by more than $\pm 15\%$, a new calibration curve must be prepared for that analyte. For volatile organics analysis in air, a 5-point calibration curve will be prepared daily. No analyses may be performed until these criteria are met.
- o Before processing any samples, the analyst should demonstrate, through analysis of a reagent blank, that interferences from the analytical system, glassware, and reagents are within acceptable limits. Each time a set of samples is extracted or there is a change in reagents, a reagent water blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement steps.

For volatile organics analysis, blanks must contain less than $2.5 \mu\text{g/L}$ methylene chloride. For other target compounds, blanks must contain less than the specified quantification limit. For other parameters, method blanks must be below

criteria guidelines specified in the method. If contaminants are present above these levels, the source of contamination must be investigated, corrective action taken and documented, and all samples associated with a contaminated blank re-analyzed. If, upon re-analysis, blanks do not meet these requirements, the Landau QAC will be notified immediately to discuss whether analyses may proceed.

- o Retention time windows will be defined by plus or minus three times the standard deviation of the absolute retention times for each standard. The laboratory must calculate retention time windows for each standard on each GC column and whenever a new GC column is installed. The data must be retained by the laboratory. All succeeding standards in an analysis sequence must fall within the daily retention time window established by the first standard of the sequence. No analyses may proceed until this criterion is met.
- o Surrogate spike analysis for volatile organics must be within the specified range for recovery limits or corrective action must be taken and documented. Corrective action includes: 1) reviewing calculations, 2) checking surrogate solutions, 3) checking internal standards, and 4) checking instrument performance. Subsequent action could include recalculating the data and/or re-analyzing the sample if any of the above checks reveal a problem. If the problem cannot be corrected through re-analysis, the QAC will be notified by the laboratory prior to data submittal, so that additional corrective action can be taken, if appropriate.

If the recovery of a surrogate compound in the method blank is outside the recovery limits, the blank will be re-analyzed along with all samples associated with that blank. If the surrogate recovery is still outside the limits, the Landau QAC will be notified immediately to discuss whether analyses may proceed.

- o If holding times are exceeded, all positive and non-detected results will be qualified as estimated concentrations. If holding times are grossly exceeded, the Landau QAC may determine the data to be unusable.
- o If laboratory instrumentation deviates from required calibration specifications, the Landau QAC will either flag data as estimated or determine it to be unusable, according to guidelines established by EPA (EPA, 1988a, 1988b).
- o If the concentrations detected in the back sorbent section of air samples are greater than 10 percent of those in the front sorbent section, breakthrough and possible sample loss will be assumed. Data will be flagged as estimated.

If analytical conditions are such that non-conformance with this QA plan is indicated, the Landau QAC will be notified as soon

as possible, so that any additional corrective actions can be taken.

Corrective Action Reports (Figure QA-10.1) will be used to document response to reported non-conformances. These reports may be generated from internal or external audits or from informal reviews of project activities (Section 12.0).

Corrective Action Reports initially will be reviewed for appropriateness of recommendations and actions by the Landau QAC (for QA matters) and by the Landau Project Manager (for technical approach). The reports will then be forwarded to the County Project Manager for review.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

All data packages reported to EPA and Ecology will include results of the QA workups and conclusions. This QA report will summarize all relevant data quality information. The Landau QAC will be responsible for data quality assessments and associated QA reports.

QA audit reports will be prepared and submitted to the Landau Project Manager and the County Project Manager. Final task or investigative reports will contain a separate QA section summarizing data quality information.

REFERENCES

APHA-AWWA-WPCF, 1985. Standard Methods for the Examination of Waste and Wastewater, 16th edition.

Golder and Envirosphere, 1987. Remedial Investigation and Feasibility Study, May 1987.

National Institute for Occupational Safety and Health Manual of Analytical Methods, July 6, 1988.

U.S. Environmental Protection Agency, 1979. Handbook for Analytical Quality Control in Water and Wastewater Laboratories (EPA-600/4-79-019).

U.S. Environmental Protection Agency, 1981. NEIC Manual for Ground Water/Subsurface Investigations at Hazardous Waste Sites (EPA-330/9-81-002).

U.S. Environmental Protection Agency, 1982. Handbook for Sampling and Sample Preservation of Water and Wastewater (EPA-600/4-82-029).

U.S. Environmental Protection Agency, 1983. Methods for Chemical Analysis of Water and Wastes.

U.S. Environmental Protection Agency, 1983. Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air (EPA-600/4-83-027).

U.S. Environmental Protection Agency, 1984. NEIC Procedures Manual for the Evidence Audit of Enforcement Investigations by Contractor Evidence Audit Teams (EPA-330/9-81-003-R).

U.S. Environmental Protection Agency, 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition (EPA-600/4-84-076).

U.S. Environmental Protection Agency, 1986a. Test Methods for Evaluating Solid Waste (SW 846), 3rd edition.

U.S. Environmental Protection Agency, 1986b. Statement of Work for Organic Analysis, Multi-media, Multi-concentration, USEPA Contract Laboratory Program.

U.S. Environmental Protection Agency, 1986c. The Quality Assurance Manual for Waste Management Branch Investigations, Region X.

U.S. Environmental Protection Agency, 1987a. A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001).

U.S. Environmental Protection Agency, 1987b. Record of Decision, Decision Summary, and Responsiveness Summary for Interim Final Remedial Action, Colbert Landfill Site, Colbert, Washington, (September).

U.S. Environmental Protection Agency, 1987a. Statement of Work for Inorganic Analysis, Multi-media, Multi-concentration, USEPA Contract Laboratory Program.

U.S. Environmental Protection Agency, 1987d. Test Method Equivalency Petitions Manual (EPA/530/SW-87/008).

U.S. Environmental Protection Agency, 1987e. Data Quality Objectives for Remedial Response Activities. EPA/540/6-87/003.

U.S. Environmental Protection Agency, 1988a. Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analysis, Hazardous Site Evaluation Division.

U.S. Environmental Protection Agency, 1988b. Laboratory Data Validation, Functional Guidelines for Evaluating Organics Analysis, Hazardous Site Evaluation Division.

APPENDIX QA-A
FIELD SAMPLING PLAN

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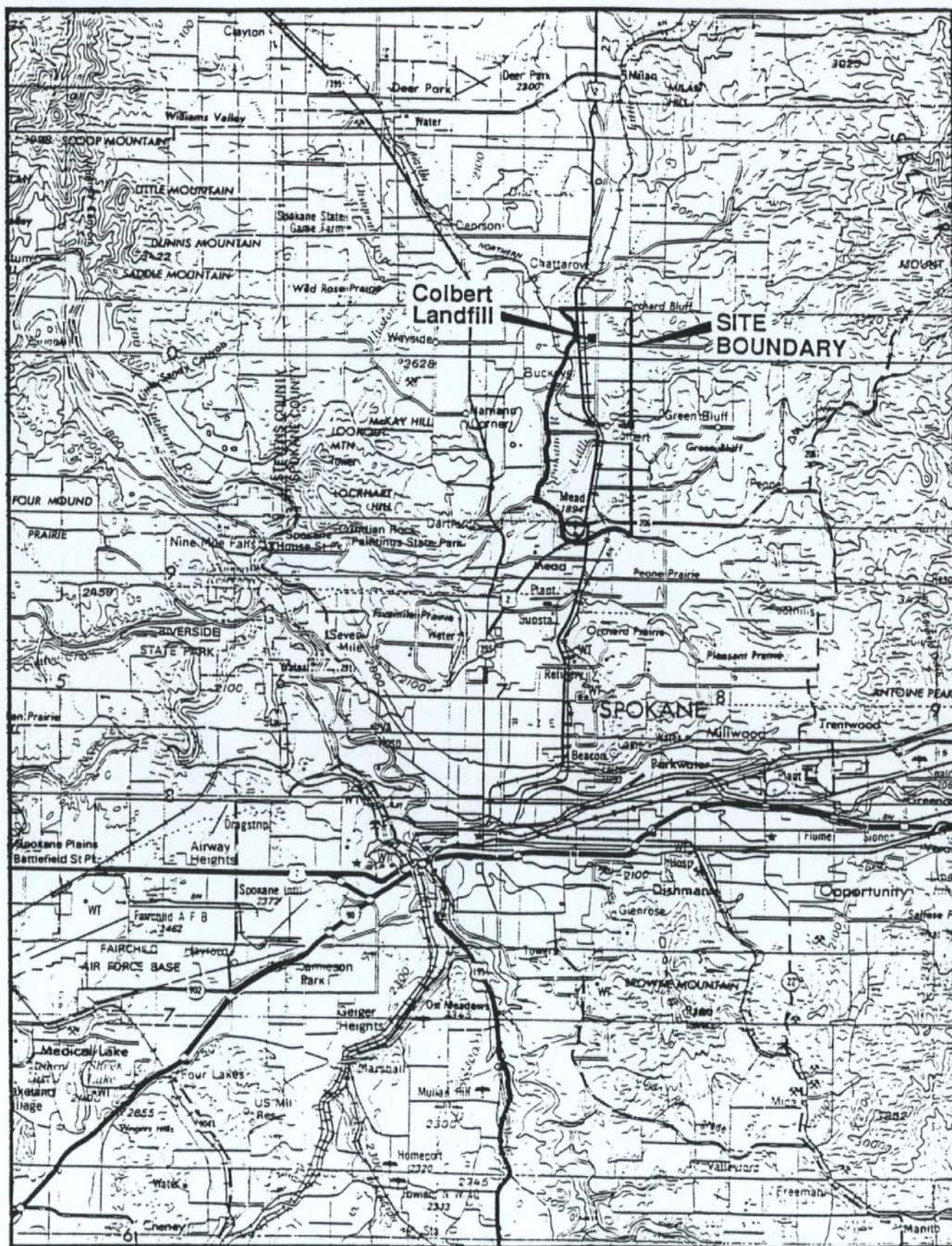
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1.0 INTRODUCTION

This Field Sampling Plan (FSP) has been prepared in conjunction with the Quality Assurance Project Plan (QAPjP) to address Phase I Remedial Design/Remedial Action (RD/RA) sampling activities at the Colbert Landfill Superfund site. The QAPjP should be referred to for a discussion of the site history and project background. A regional location map of the Colbert Landfill vicinity is provided on Figure FS-1.1.

The purpose of the FSP is to provide detailed information on the procedures to be implemented when obtaining samples of physical media (air, soil, and water) at the Colbert Landfill Superfund site during Phase I RD/RA activities. These procedures are intended to be consistent with the data quality objectives set forth in QAPjP Sections 1.0, 2.0, and 3.0.



Source: U.S.G.S. Topographic Map of Spokane, Washington; Idaho; Montana, 1980.

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Regional Location Map of
Colbert Landfill Site

2.0 SAMPLING OBJECTIVES

The objective of the FSP is to assure that accurate, reproducible, comparable, and consistent data are acquired during Phase I of the Colbert Landfill RD/RA. To achieve this objective, this document details sample collection, handling, documentation, and security procedures. These procedures have been written to comply with the Compendium of Superfund Field Operations (EPA/540/P-87/001, OSWER 9355.014, September 1987a), and to meet the DQOs described in Section 1.3 of the QAPjP. Standards have been developed for evaluation of the field sampling procedures with respect to the project objectives.

Any changes in sampling procedures as outlined in this document will be described on the Modification to Field Sampling Plan form (Figure FS-2.1). Approval from the Landau Project Manager will be needed prior to implementation of any changes.

LANDAU ASSOCIATES, INC.
MODIFICATION TO FIELD SAMPLING PLAN

Sample Program Identification: _____

Material to be Sampled: _____

Measurement Parameter: _____

Standard Procedure for Analysis: _____

Reference: _____

Variation from Standard Procedure: _____

Reasons for Variation: _____

Special Equipment, Material or Personnel Required: _____

Author's Name: _____

Approval: _____ Title: _____ Date: _____

Reviewed by: _____

Comments: _____

Reviewed by: _____

Comments: _____

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Modification to Field Sampling Plan

3.0 SAMPLE LOCATION AND FREQUENCY

Soil, ground water, and air samples will be collected during Phase I of the Colbert Landfill RD/RA project. Phase I sampling efforts are performed for three main purposes:

- (1) Geologic/hydrogeologic characterization,
- (2) Ground water quality characterization (including contamination distribution), and
- (3) Pilot study performance evaluations.

Phase I sampling activities are defined for each of the three areas where interception/extraction systems are anticipated to be installed for the Phase II (Final) Remedial Action. Samples to be collected from the South, West, and East Systems are described below:

(1) South System

- o Subsurface soil samples collected during borehole installations,
- o Ground water samples from three to five new monitoring wells,
- o Ground water samples from up to three existing monitoring wells, and
- o Ground water samples from the pilot extraction well and pilot treatment facility effluent.

(2) West System

- o Subsurface soil samples collected during borehole installations,
- o Ground water samples from four to six new monitoring well locations (one to three monitoring wells at each location),
- o Ground water samples from up to five existing monitoring wells, and
- o Ground water samples from the pilot extraction well and pilot treatment facility effluent.

(3) East System

- o Subsurface soil samples collected during borehole installations,
- o Ground water samples from four to eight new monitoring well locations (one to three wells at each location),
- o Ground water samples from up to twelve existing monitoring wells,
- o Ground water samples from the two pilot extraction wells and the pilot treatment facility effluent, and
- o Air samples (one upwind and two downwind) from the pilot treatment facility.

Soil samples will be collected for geologic/hydrogeologic evaluations only and approximately one to three samples from each monitoring well location will be analyzed for grain size, unit weight, and water content. However, soil contaminant levels will be qualitatively evaluated by monitoring the air directly above soil samples for organic vapors with a photoionization meter. This procedure will be performed immediately following exposure of the sample to the atmosphere and readings will be recorded on the log of exploration.

Ground water samples will be field tested for temperature, pH, and conductivity, and subsequently analyzed for chlorinated volatile organics. The first round of samples collected from each well and treatment plant influent/effluent samples will be analyzed for the full list of Method 8010 constituents. A list of these constituents is provided in Table QA-7.1 of the QAPjP. However, analysis for subsequent sampling rounds will be abbreviated to the six "Constituents of Concern" (1,1,1-trichloroethane [TCA], 1,1-dichloroethylene [DCE], 1,1-dichloroethane [DCA], trichloroethylene [TCE], tetrachloroethylene [PCE], and methylene chloride [MC]),

except for locations where the first sampling event indicates that other volatile organic compounds are present at significant concentrations.

Ground water analysis for other parameters will be performed for treatment system design. Ground water samples from one well group in the South, East, and West Systems will be analyzed for hardness, iron, and manganese. The concentration of these parameters will be used to determine whether stripping tower pretreatment chemicals are needed. In addition, ground water samples from each well within one well group in the East and West Systems will be analyzed for seven landfill leachate parameters, including: chemical oxygen demand (COD), total organic carbon (TOC), total organic halides (TOX), chloride, sulfate, nitrate/nitrite, and total dissolved solids (TDS).

The Phase I pilot treatment plant(s) will be constructed after the South, East, and West monitoring wells and pilot extraction wells are installed and sampled. During the pilot study, treatment system influent/effluent samples and samples from selected monitoring wells will be analyzed to evaluate operational performance. Upwind and downwind air samples will be collected and analyzed during the East System treatability studies.

Table FS-3.1 outlines the sampling and analysis program for the Phase I RD/RA activities. Approximate locations for monitoring and pilot extraction wells to be constructed during Phase I are shown on Figure FS-3.1. The estimated schedule for Phase I activities is presented on Figure FS-3.2.

TABLE FS-3-1
PHASE I SAMPLING AND ANALYSIS PROGRAM
COLBERT LANDFILL REMEDIAL DESIGN/REMEDIAL ACTION

Project Activity	Sample Type and Location	Total Number of Samples	Purpose of Sampling	Matrix	Analysis	Frequency
Geologic/Hydrogeologic Characterization	Borehole Samples(a)		- Characterization of	Soil	Physical testing, including: grain size analysis (ASTM D422-63) moisture content (ASTM D-2216-80), and unit weight (ASTM D2937-83) on selected samples.	About every 5 feet during boring advancement.
	South System (4-6 wells) 100-120 ft. deep	~80 to 140	Geologic/Hydrogeologic Units.			
	West System (9-15 wells)(b) 200-350 ft. deep	~500 to 900	- Physical testing.			
	East System (6-18 wells)(c) 100 to 250 ft. deep	~200 to 650				
		----- ~780 to 1690				
Ground Water Characterization	Monitoring and Extraction Well Samples(d)		Characterization	Ground water	Chlorinated volatile organic compounds (Method 8010)	Once after development.
	South System (4-9 wells)	4 to 9	of chlorinated			
	West System (9-20 wells)(b)	9 to 20	volatile organics			
	East System (6-30 wells)(c)	6 to 30	in Monitoring Wells.			
		----- 19 to 59				
	Monitoring Well Samples		Characterization for	Ground water	Chemical Oxygen Demand; Total Organic Carbon; Chloride; Sulfate; Nitrate; Total Dissolved Solids; Total Organic Halides	Once after development.
	West System (1 location)(b)	2 to 3	leachate parameters.			
	East System (1 location)(c)	1 to 3				
		----- 3 to 6				
	Monitoring Well Samples		Pretreatment			
	South System (1 well)	1	requirements for	Ground water	Hardness Iron Manganese	Once after development.
	West System (1 location)	2 to 3	stripping tower.			
	East System (1 location)	1 to 3				
		----- 4 to 7				

(a) Borings for monitoring and extraction well installations.

(b) Assumes two to three monitoring wells at each initial location, one monitoring well at additional locations.

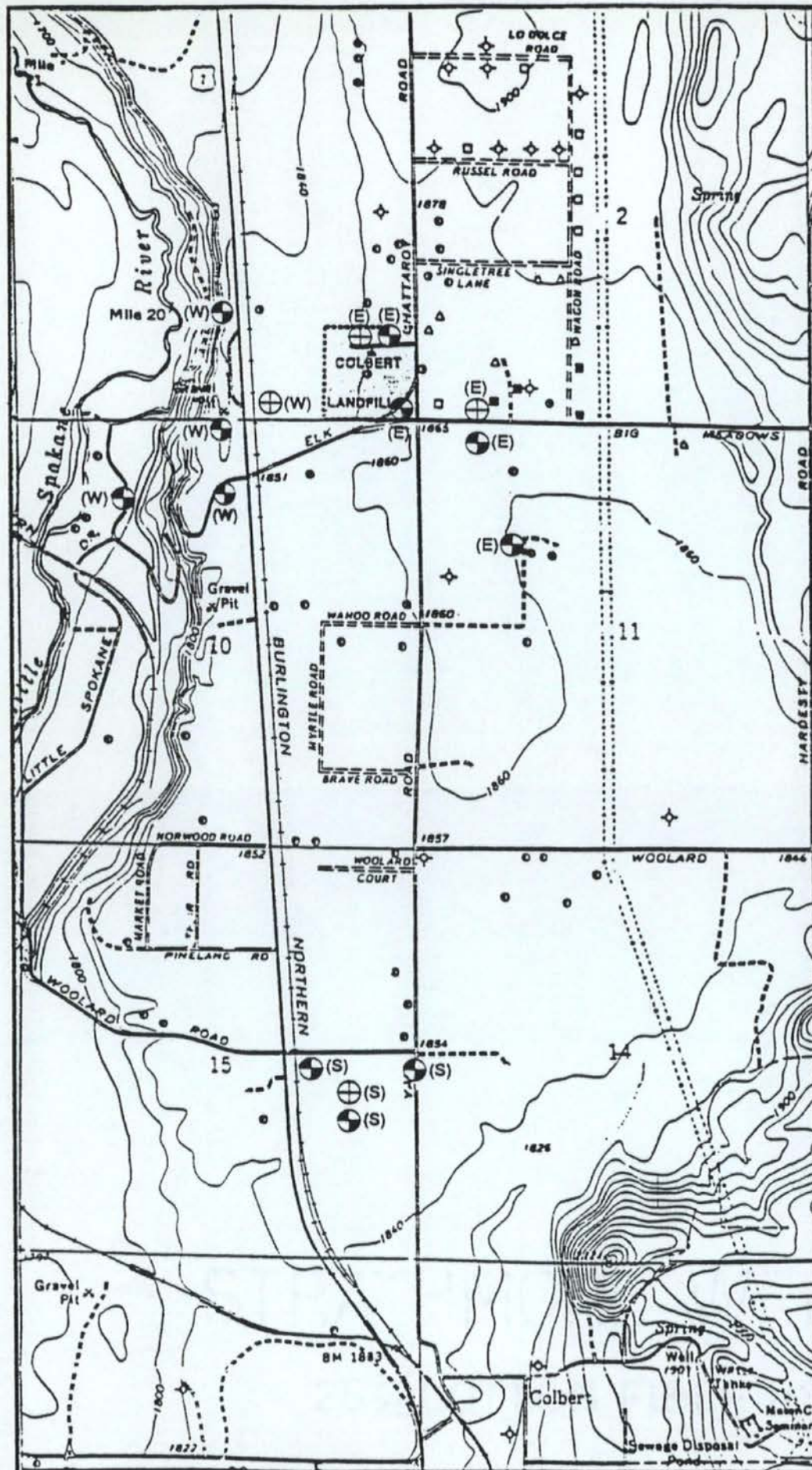
(c) Assumes one to three monitoring wells at each initial location, one monitoring well at additional locations.

(d) Includes samples for up to 20 existing monitoring wells (as described in Section 3.0).

TABLE FS-3-1 (CONTINUED)
 PHASE I SAMPLING AND ANALYSIS PROGRAM
 COLBERT LANDFILL REMEDIAL DESIGN/REMEDIAL ACTION

Project Activity	Sample Type and Location	Total Number of Samples	Purpose of Sampling	Matrix	Analysis	Frequency
Phase I Pilot Study	Pilot Extraction Well Samples		- Characterization	Ground water	Chlorinated volatile organic compounds (Method 8010)	Once weekly for the first four weeks of the Pilot Study(e). If Pilot Study extends beyond 4 weeks, additional samples collected on a quarterly basis.
	South System (1 well)	4	of chlorinated			
	West System (1 well)	4	volatile organics			
	East System (2 wells)	8	in Extraction Wells.			
		---	- Mass balance.			
		16				
	Monitoring Well Samples		Characterization of	Ground water	Chlorinated volatile organic compounds (Method 8010)	Once weekly for the first four weeks of the Pilot Study. If Pilot Study extends beyond 4 weeks, will collect additional samples on a quarterly basis.
	South System (2 wells)	8	chlorinated volatile			
	West System (2 locations)	8 to 24	organics in Monitoring			
	East System (2 locations)(f)	16 to 32	Wells during pilot			
		-----	studies			
		32 to 64				
	Stripping Tower Effluent Samples	12 to 16	- Phase II design information, including mass balance(g). - Verify effluent meets Scope of Work (Table IV-1) Evaluation Criteria	Ground water	Chlorinated volatile organic compounds (Method 8010)	Once weekly for the first four weeks of the Pilot Study. If Pilot Study extends beyond 4 weeks, will collect additional samples on a quarterly basis.
	Air Samples	16	Air emissions data for	Air (Sorbent Tube)	Chlorinated volatile organic compounds (NIOSH Method 1003, 1005, 1022)	Once weekly for the first four weeks of the East System Pilot Study. If Pilot Study extends beyond 4 weeks, will collect additional samples on a quarterly basis.
	2 Downwind Sampling Stations		air modeling studies			
	1 Upwind Sampling Station					
	1 Blank					

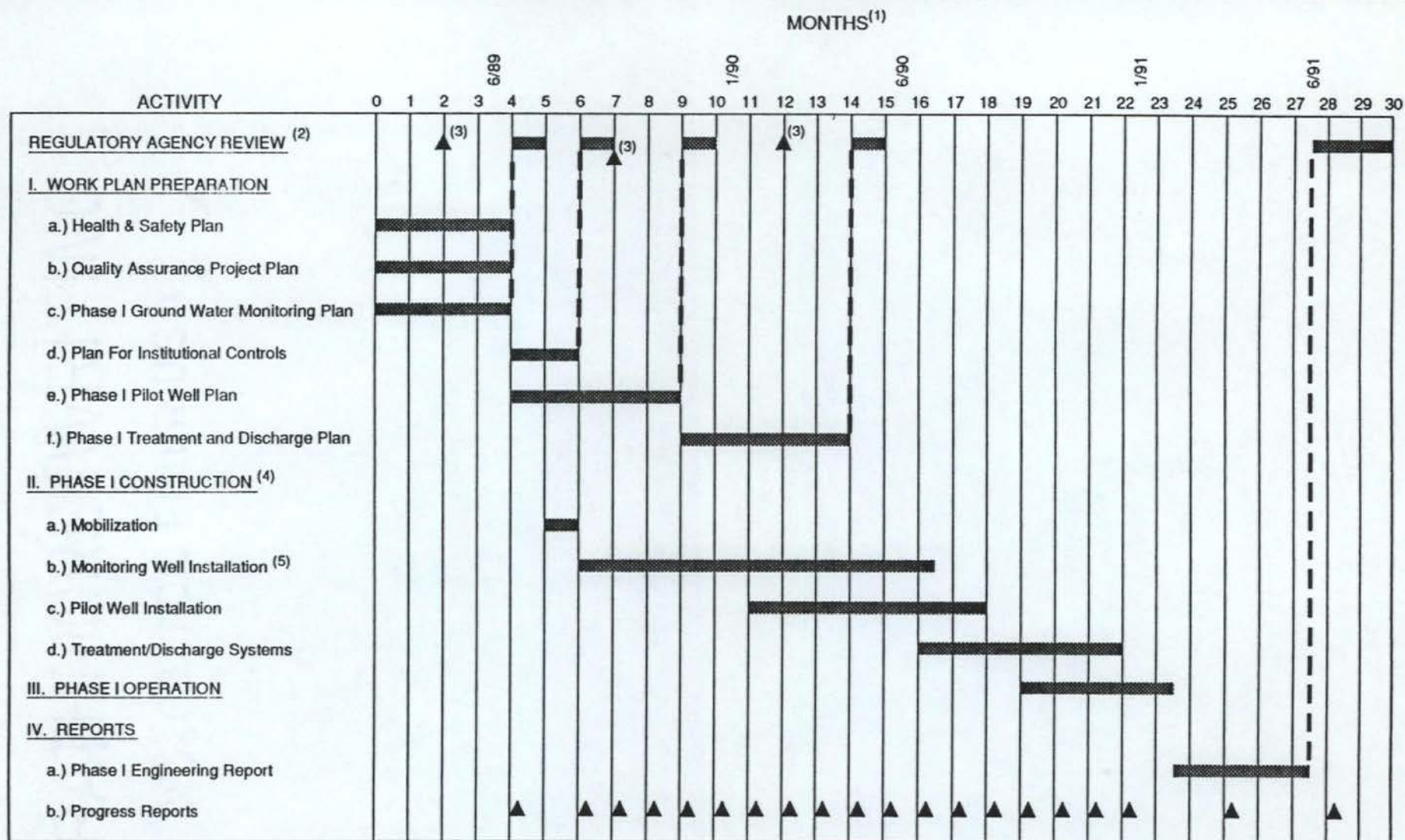
- (e) Pilot studies will be conducted consecutively for the South, West, and East Systems. Pilot studies for the two East System extraction wells may (or may not) be conducted concurrently.
- (f) Only monitoring wells installed in the Lower Aquifer will be sampled during pilot studies.
- (g) Extraction well chemical analysis will be used as influent concentration for mass balance calculations.



KEY

- Approximate location of Proposed Monitoring Well or Monitoring Well Group
- Approximate location of Proposed Pilot Extraction Well
- (S) South System
- (W) West System
- (E) East System

0 2000
Scale in Feet



Notes:

- 1.)

 3 ← Date

 4 ← Time since entry of the Consent Decree

- 2.) Estimated Schedule. Schedule dependent on actual Agency review period.
- 3.) County-Agency technical session at 50% completion of work plans.
- 4.) Phase I Construction initiated 30 days following agency approval of Work Plans I. a.), I. b.), and I. c.).
- 5.) Estimated time. Actual time will depend on drilling method.

Source: Schedule for Submittal of Deliverables (Landau, 1989)

LANDAU ASSOCIATES, INC.

Estimated Schedule
Phase I Activities

Figure FS-3.2

4.0 SAMPLING EQUIPMENT AND PROCEDURES

This section presents the required equipment and step-by-step procedures for ground water, subsurface soil, stripping tower influent and effluent, and air sampling. A summary of sample containers, preservation requirements, and holding times is presented in Table FS-4.1.

4.1 GROUND WATER MONITORING WELL SAMPLING

It is anticipated that about 60 to 140 ground water monitoring well samples will be collected and analyzed for Method 8010 chlorinated volatile organics during Phase I activities. In addition, 7 to 13 monitoring well samples will be analyzed for treatment system design parameters: 1) ground water samples from one East System and one West System well group will be tested for landfill leachate parameters (COD, TOC, TOX, chloride, sulfate, nitrate/nitrite, and TDS); and 2) one well group from the South, West, and East Systems will be tested for hardness, iron, and manganese.

Samples for landfill leachate parameter analysis will be collected from the East and West System well groups first because these systems are close to the landfill site, and are more likely to be affected by landfill leachate than the South System (which is over 8,000 feet from the landfill). If significant concentrations of the leachate parameters are detected in the East and West System well groups, the South System may also be tested for leachate parameters at the discretion of Spokane County.

TABLE FS-4.1

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Bottle ^(a) Code	Analyses	Sample Container	Preservation	Holding ^(b) Time
Ground Water	N	Sulfate	16 oz. plastic	Cool, 4° C	28 days
		Chloride			28 days
		Total Dissolved Solids			7 days
	A	Nitrate/Nitrite Hardness	8 oz. plastic	Cool, 4° C H ₂ SO ₄ to pH < 2	14 days 6 months
	S	Chemical Oxygen Demand	16 oz. glass	Cool, 4° C H ₂ SO ₄ to pH < 2	28 days
	O	Total Organic Carbon	100 mL glass Teflon-lined septum cap (leave no headspace)	Cool, 4° C H ₂ SO ₄ to pH < 2	28 days
	V	Volatiles	2 ea - 40 mL glass vials (leave no headspace) Teflon-lined septum cap	Cool, 4° C	14 days
	M	Metals (Fe,Mn)	16 oz. plastic	HNO ₃ to pH < 2	6 months
	X	Total Organic Halides	250 mL amber glass Teflon-lined septum cap	Cool, 4° C H ₂ SO ₄ to pH < 2	14 days
Air	T	Volatile Organics	Charcoal tube	Cool, 4° C	7 days

(a) Bottle code to follow sample station number.

(b) Holding times are from date of collection. All samples will be shipped to the laboratory within 24 hours (except as noted for samples collected on Friday).

Ground water monitoring well sampling will be performed at each monitoring well in accordance with the procedures described in the following subsections. Ground water samples collected from pilot extraction wells prior to the pilot studies will also use these procedures; subsequent extraction well samples will be collected as stripping tower influent (Section 4.2).

4.1.1 Water Level Measurements

Water levels will be measured just prior to purging and sampling with an electronic water level indicator. Measurements will be taken from the surveyed point on the top of the PVC well casing. If a non-dedicated water level probe is used, it will be decontaminated before and after each measurement with a distilled water rinse. Depth to water will be recorded to the nearest 0.01 foot on the Sample Collection Form (Figure FS-4.1).

4.1.2 Purging the Well

The well will be purged by removing at least three well volumes of water from the casing using a gas-driven, piston, or bladder pump fitted with teflon-lined polyethylene or stainless steel tubing (a submersible pump may be used for pilot extraction wells). If the pump is non-dedicated, it will be washed with an Alconox and water solution, rinsed with tap water, and then rinsed with distilled water.

The well purge volume will be calculated based on the following formula: one well volume (gallon) = $\pi r^2 h \times 7.48$ gal/ft³; where $\pi = 3.14$, r = radius of well casing in feet, h = height of water column from the bottom of the well in feet. Well

depth measurements will be obtained after well installation and will be provided to the ground water sampling team. Information on purge volume, time of initiation and termination of pumping, plus a description of the physical characteristics of purge water (color, turbidity, etc.) based on visual observation, will be recorded on the Sample Collection Form (Figure FS-4.1). In most instances, sampling will be completed the same day as well purging. However, if the well becomes dry during purging, it will be sampled as soon as the water level has recovered enough to allow collection of the necessary samples, which may require sampling on a subsequent day. The elapsed time between purging and sampling will be recorded on the Sample Collection Form.

4.1.3 Ground Water Sampling Equipment

Samples will be collected with the aid of a bladder pump, piston pump, or bailer (stainless steel or teflon). If the pump or bailer is non-dedicated, it will be washed with an Alconox and water solution, rinsed with tap water, and then rinsed with distilled water following use. The pump (or bailer) will also be rinsed with distilled water prior to use at a new location.

The following precautions will be followed when using a non-dedicated pump or bailer to collect ground water samples:

- o The pump or bailer will be lowered slowly into the well, and
- o The pump or bailer will not be allowed to come into contact with any surface other than the inside of the well.

SAMPLE COLLECTION FORM

SAMPLE NUMBER

Collector _____

Proj. Name _____ Job No. _____

Sample Location & Depth _____

Sample Type: Soil, Ground Water, Other _____

Date Collected (d/m/yr) _____ Time (24-hr.) _____

Weather _____

Sample Collected With: Bailer; Pump; Split Barrel; Other _____

Made of: Stainless Steel; PVC; Teflon; Other _____

PURGE DATA Depth to Water (top of PVC): _____

(d/m/y/hr)

Begin _____ One Casing Vol. (gal) = _____

End _____ Gallons Purged = _____

(Remove 3 well volumes or until dry)

Description (color, texture, density, moisture, turbidity, etc.)

FIELD	Replicate	pH	Cond. (uS)	Temp.:
PARAMETERS	1	_____	_____	F C
	2	_____	_____	
	3	_____	_____	
	4	_____	_____	

Meter used for measurement: _____

Sample composited over time, distance: _____

Quantity, types of sample containers: _____

Duplicated sample number(s): _____

Well Condition: _____

(1. Well caps are secure and operational; 2. Visible damage to well)

Comments (why analyze; calculations; etc.)

Signature _____ Date (d/m/y) _____

9/87

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Sample Collection Form

4.1.4 Sample Containers

Certified sample containers which have been cleaned to EPA specifications will be obtained from a bottle-supply firm through the analytical laboratory; the laboratory will add the proper preservatives to the appropriate containers prior to sample collection.

4.1.5 Sample Labels

Sample labels are necessary to properly identify samples. Gummed paper labels or tags are adequate for the anticipated Phase I activities and will include the following information:

- o Sample identification number,
- o Date and time,
- o Name of sampler, and
- o Pertinent field information.

Labels will be completed and affixed to sample containers prior to or at the time of sampling.

4.1.6 Field Measurements

Calibration - Conductivity and pH meters will be calibrated following the manufacturer's procedures (see QAPjP Appendix QA-B) provided with the instruments. Calibration will be accomplished prior to sampling each well, or at least once every four hours of sampling. Calibration adjustments will be recorded in a log book maintained for each meter. Before each sample is collected, the calibration will be checked by measuring the pH 7 buffer solution and recording that reading and the temperature on the Sample

Collection Form. If readings are within 0.1 pH units of the pH 7 buffer, no recalibration is needed.

Measurements - Four replicate field measurements of pH and conductivity will be made using the following procedure:

- o Rinse a 250 milliliter (ml) plastic beaker three times with sample water;
- o Rinse the electrode, dip cell, and temperature compensation probe by storing them in sample water for at least one minute;
- o Set the automatic temperature compensator to the "on" position;
- o Fill the beaker with sample water; place the probes in the beaker until the reading stabilizes. Read the temperature, pH, and conductivity measurements and record on the Sample Collection Form;
- o Measure and record three additional sample replicates by repeating this last step; rinse beaker with distilled water and an aliquot of the sample water to be measured between each measurement; and
- o Note any problems or significant observations in the "comments" section of the Sample Collection Form (Figure FS-4).

4.1.7 Filling Sample Bottles

Sample bottles will be filled directly from the bailer or pump, and will be filled with a minimal amount of air contact when sampling for volatile organics. The flow rate from the pump or bailer should be adjusted to approximately 100 milliliters per minute, and should be a slow steady stream.

The following procedures and precautions will be adhered to when filling sample bottles:

- o Bottle caps will be removed carefully so that the inside of the cap is not touched. Caps will not be placed on the ground. Caps for volatile organics analyses contain a teflon-lined septum. The teflon side of the septum must be facing the sample to prevent contamination of the sample through the septum.

- o The sample bottles will be filled with a minimal amount of air contact and without allowing the sampling equipment or personnel to contact the inside of the bottles. Tubing or hoses from pumps will not be placed into the sample bottles.
- o Sample bottles containing preservatives should be filled completely without allowing any sample to overflow the top of the bottle. Bottle caps should be replaced tightly.
- o Vials for volatile organics analyses will be filled so that they are headspace-free (i.e., no air bubbles in the sample bottle). The caps will be replaced gently, so as to eliminate any air bubbles in the sample. These bottles will then be checked for air bubbles by inverting them and shaking the bottle. If any air bubbles appear, the bottles will be opened, drained, and refilled. This process will be repeated until all air bubbles are eliminated.
- o Each sample bottle will be placed in a plastic bag. Samples should be placed into an iced cooler immediately after collection. Loss of volatile organics may occur by exposure to sunlight and warm temperatures.

4.1.8 Ground Water Well Quality Control Samples - Volatile Organics Analyses

The four types of field quality control samples which will be collected for volatile organics analyses are: 1) rinsate blank, 2) field duplicate, 3) transfer blank, and 4) trip blank. These types of field quality control samples are described below:

- o Rinsate Blanks: A minimum of 5 percent of the total number of ground water samples for volatile organics analyses will be collected as rinsate blanks to check equipment decontamination procedures. Rinsate blanks will be collected following sampling from wells which are expected to contain relatively high concentrations of volatile organics. Equipment rinsate blanks will be prepared without making any special effort when decontaminating the sampling equipment. The rinsate blank will consist of deionized/distilled water poured over the cleaned sampling equipment and collected into septum vials (appropriately sized containers) for laboratory analysis.
- o Field Duplicate Samples: A minimum of 5 percent of the total number of ground water samples will be collected as field duplicates. As a minimum, one duplicate will be collected from each of the South, West, and East Systems during Phase I sampling. Duplicate samples will be collected by alter-

nately discharging the pump or bailer into duplicate sample bottles. Each duplicate sample will have a separate sample number and Sample Collection Form.

- o Transfer Blanks: A minimum of 5 percent of the total number of ground water samples will be sent to the laboratory as transfer blanks. A transfer blank will be collected by transferring deionized/distilled water, provided by the analytical laboratory, into a set of sample bottles. Each transfer blank will be identified and logged on a separate Sample Collection Form. Upon return to the laboratory, the transfer blank will be analyzed as if it were a field sample, following the same QA/QC procedures as ordinary samples.
- o Trip Blanks: A minimum of 5 percent of the total number of ground water samples will be sent to the laboratory as trip blanks. A trip blank will consist of a sample bottle filled with deionized/distilled water by the analytical laboratory. The blank will remain with the sample bottles in transit to and around the site during sampling and on the return trip to the laboratory. At no time during these sampling activities is the trip blank to be opened. Upon return to the laboratory, the trip blank will be analyzed as if it were another field sample receiving the same QA/QC procedures as ordinary samples.

4.1.9 Ground Water Quality Control Samples - Hardness, Iron, Manganese, and Leachate Parameter Analyses

Ten percent of the total number of ground water well samples for treatment system design analyses (hardness, iron, manganese) or landfill leachate parameters will be collected as quality control samples. The number of samples collected for these parameters is expected to be 7 to 13; therefore, only two quality control samples will be collected. Of the four types of quality control samples, only a field duplicate and rinsate blank sample will be collected.

4.1.10 Chain of Custody

To establish the documentation necessary to trace sample possession from the time of collection, a Chain-of-Custody Record similar to that shown on Figure FS-4.2 will be filled out and will

accompany every sample delivery to the laboratory. The record will contain the following information:

- o Sample identification number,
- o Name of sampler,
- o Date and time of collection,
- o Signature of persons involved in the chain of possession (the sampler will be the first person to relinquish custody), and
- o Inclusive dates of possession.

The Chain-of-Custody Record will be completed in duplicate for all sampling. Copies of the completed Chain-of-Custody Records will be retained by the analytical laboratory, in the Landau project files, and by the Landau QAC. The laboratory will include a copy of the Chain-of-Custody Record in its report of analytical results.

4.1.11 Chain-of-Custody Seal

A Chain-of-Custody Seal similar to that shown on Figure FS-4.3 (used to detect unauthorized tampering with the samples) will be placed on the ice chest after collection of all samples and whenever samples are left unattended. The seal will include, at a minimum, the sampler's name and the date. The seal must be attached such that it must be broken in order to open the ice chest. The seals must be affixed to the ice chest before the sampling personnel will relinquish custody of the samples.

Date _____
Page _____ of _____

[illegible]

Chain of Custody Record

Chain of Custody Seal

Person Collecting Sample _____ (signature) No. of Samples _____

Date Sealed _____ Time Sealed _____

Location _____

4.1.12 Field Records

Field log books, plus the Sample Collection Forms, will be used to record all information pertinent to the field survey of the sampling event. The records will contain sufficient information to permit reconstruction of sampling events without reliance on the sampler's memory. All field log books and forms will be retained by the Landau Field Coordinator and secured in a safe place.

4.1.13 Shipment of Samples

A Sample Analysis Request Packing List (Figure FS-4.4) will accompany the samples to the laboratory. This form will be completed by field personnel and will specify the analysis to be performed by the analytical laboratory. Samples will be shipped to the laboratory within 24 hours of sampling, except as noted in Section 5.1 for samples collected on Friday.

The samples will be accompanied by a Chain-of-Custody Record and will be delivered to the laboratory representative authorized to receive samples. The laboratory representative will sign the Chain-of-Custody Records to verify delivery/receipt. Further instructions on sample packaging and shipping are outlined in Section 5.1.

4.2 STRIPPING TOWER INFLUENT/EFFLUENT SAMPLING

It is anticipated that 28 to 32 stripping tower influent and effluent samples will be collected and analyzed during the Phase I pilot studies to evaluate the volatile organic removal efficiency of the treatment system. The first set of samples will be analyzed

LANDAU ASSOCIATES, INC.
SAMPLE ANALYSIS REQUEST PACKING LIST

SAMPLER: <hr/>	Sampling Date(s): <hr/>	Ship To: <hr/>	For Lab Use Only <hr/>
Sampling Contact: <hr/> <p style="text-align: center;">(name)</p> <hr/> <p style="text-align: center;">(phone number)</p>	Date Shipped: <hr/> Site Name/Code: <hr/>	 Attn: <hr/>	 Date Samples Rec'd <hr/> Rec'd By: <hr/>

Sample Numbers	Sample Description i.e., Requested Analysis, Matrix, Concentration	Sample Condition on Receipt at Lab
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____
11. _____	_____	_____
12. _____	_____	_____
13. _____	_____	_____
14. _____	_____	_____
15. _____	_____	_____
16. _____	_____	_____
17. _____	_____	_____
18. _____	_____	_____
19. _____	_____	_____
20. _____	_____	_____

For Lab Use Only

LANDAU ASSOCIATES, INC.

Sample Analysis Request Packing List

for the full list of Method 8010 chlorinated volatile organics. Subsequent tests will include only the six constituents of concern unless other contaminants are present at significant levels. Stripping tower influent/effluent sampling will be performed in accordance with the procedures described in the following subsections.

4.2.1 Sample Collection Procedures

Samples of stripping tower influent/effluent will be collected using the same procedures described in Sections 4.1.4 through 4.1.7 for ground water monitoring wells; except stripping tower influent/effluent samples will be collected from access ports located on (or adjacent to) the treatment facility, so sampling equipment will not be needed.

4.2.2 Stripping Tower Quality Control Samples

Approximately 20 percent of the total number of stripping tower influent/effluent samples will be collected as quality control samples. Whenever possible, every tenth sample will be either a duplicate or transfer blank. Trip blanks will accompany each cooler. Rinsate blanks will not be collected because samples will be collected from dedicated equipment (i.e., sample ports permanently installed on the stripping tower). The types of field quality control samples are described below:

- o Duplicate Samples: Duplicate samples will be collected every twentieth sample (a minimum of one) by alternately filling duplicate sample bottles. Each duplicate sample will have a separate sample number and Sample Collection Form so that the laboratory does not know the sample is a duplicate.
- o Transfer Blanks: A transfer blank will be collected every twentieth sample (a minimum of one) by transferring deionized/

distilled water provided by the testing laboratory into a set of sample bottles. Each transfer blank will be identified and logged on a separate Sample Collection Form. Upon return to the laboratory, the transfer blank will be analyzed as if it were a field sample, following the same QA/QC procedures as ordinary samples.

- o Trip Blanks: A trip blank shall accompany each cooler containing stripping tower samples. A trip blank will consist of a sample bottle filled with deionized/distilled water by the laboratory. The blank will remain with the sample bottles in transit to and around the site during sampling and the return trip to the laboratory. At no time during these sampling activities is the trip blank to be opened. Upon return to the laboratory, the trip blank is analyzed as if it were another field sample following the same QA/QC procedures as ordinary samples.

4.2.3 Chain of Custody

To establish documentation necessary to trace sample possession from the time of collection, a Chain-of-Custody Record similar to that shown on Figure FS-4.2 will be completed and will accompany every sample delivery to the laboratory. The record will contain the following information:

- o Sample identification number,
- o Name of sampler,
- o Date and time of collection,
- o Signature of persons involved in the chain of possession (the sampler will be the first person to relinquish custody), and
- o Inclusive dates of possession.

The Chain-of-Custody Record will be completed in duplicate. Copies of the completed Chain-of-Custody Records will be retained by the analytical laboratory, in the Landau project files, and by the Landau QAC. The laboratory will include a copy of the Chain-of-Custody Records in its report of analytical results.

4.2.4 Chain-of-Custody Seal

A Chain-of-Custody Seal similar to that shown on Figure FS-4.3 (used to detect unauthorized tampering with the samples) will be placed on the ice chest after the collection of all samples. The seal will include, at a minimum, the sampler's name and the date. The seal must be attached such that it must be broken in order to open the ice chest. Seals must be affixed to the ice chest before the sampling personnel will relinquish custody of the samples.

4.2.5 Field Records

Field log books, plus the Sample Collection Forms, will be used to record all information pertinent to the sampling event. The records will contain sufficient information to permit reconstruction of sampling events without reliance on the sampler's memory. All field records will be retained by the Landau Field Coordinator and secured in a safe place.

4.2.6 Shipment of Samples

A Sample Analysis Request Packing List (Figure FS-4.4) will accompany the samples to the laboratory. This form will be completed by field personnel and will specify the analyses to be performed by the analytical laboratory. The samples will be delivered to the laboratory within 24 hours of sampling, except as noted in Section 5.1 for samples collected on Friday. The samples will be accompanied by a Chain-of-Custody Record and will be delivered to the laboratory representative authorized to receive

samples. Chain-of-Custody Records will be signed by the laboratory representative to verify delivery/receipt.

4.3 AIR SAMPLING

It is anticipated that about 16 air samples will be collected and analyzed during Phase I-East pilot studies to characterize stripping tower air emissions. These samples will be analyzed for the six chlorinated volatile organic "Constituents of Concern". Solid sorbent cartridges will be used to collect samples of volatile organics in ambient air upwind and downwind of the pilot treatment system. The sample apparatus will consist of a sampling cartridge packed with coconut shell charcoal and a pump system capable of maintaining a constant flow rate across the collection media for a specified period of time.

In principle, organic vapors present in the air are adsorbed on the collection media and subsequently, chemically desorbed in the laboratory. Each sorbent tube contains two chambers. The second chamber will be analyzed to detect saturation and breakthrough of the first chamber. An aliquot of the sample is then analyzed by a gas chromatograph followed by flame ionization detection.

Final design of the air sampling network will be accomplished after the chlorinated volatile organic mass loading to the treatment system has been estimated (based on initial Phase I analytical results) and local weather patterns have been established. Exact location, flow rate, and sample collection time will be submitted to EPA and Ecology prior to implementation. All

specifications and procedures will be in compliance with the criteria given within the NIOSH methods.

Sorbent tube sampling procedures are described in the following subsections:

4.3.1 Sampling Tubes

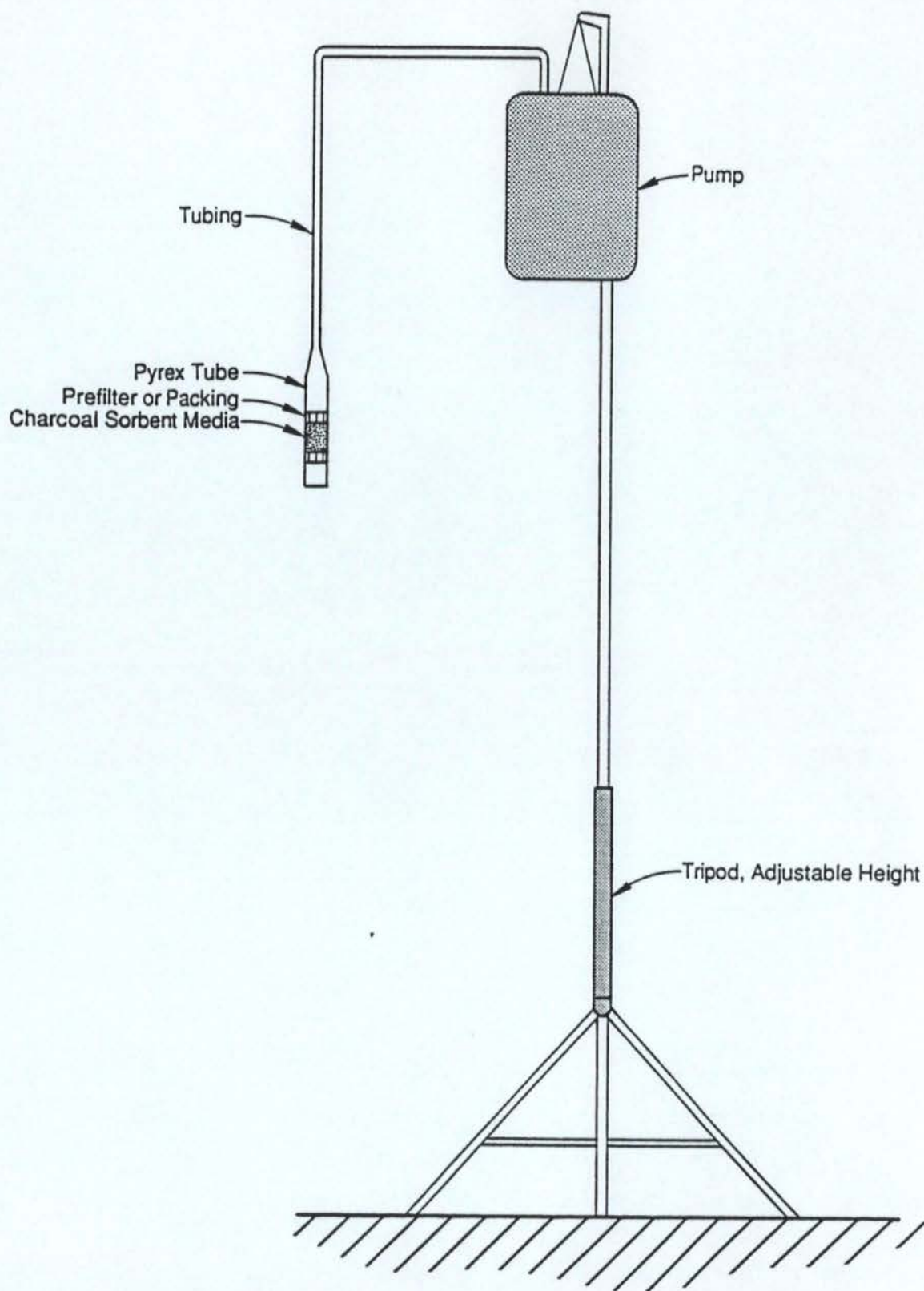
The sampling tubes will be obtained from the laboratory. The laboratory will insure that the tubes are thoroughly precleaned, conditioned, and checked for freedom from interferences prior to use. The laboratory will supply the sampling tubes in Teflon-capped culture tubes packed in aluminum foil, and then one 1-gallon paint can for shipment to and from the field. The laboratory will include one sorbent tube in every shipment which will be returned to the laboratory unopened and will be analyzed as a blank sample.

4.3.2 Sample Collection Procedures

The following procedures will be adhered to when collecting air samples:

- o Record ambient air temperature, wind speed, and direction.
- o If pump battery test is available, check battery.
- o Place a sorbent cartridge in line and start pump. Allow air sampling pump to stabilize. Do not use this 'calibrator' cartridge for actual sampling; however, it can be reused for additional calibration tests.
- o Determine actual flow rate with rotometer.
- o Adjust flow rate of the sampler to the desired rate by adjusting the needle valve. Verify that the flow rate has been achieved by checking against the rotometer three times. Calculate the mean value by summing the values of the three individual readings and dividing by three. The deviation of the individual flow rates from the mean flow rate should not exceed ± 5 percent.

- o Assemble the sampling apparatus (Figure FS-4.5). Set apparatus at desired location and hang samplers on a tripod, music stand, or similar device. To insure stability in wind gusts, weighting of these devices or some method of anchoring is advisable. Wooden posts may be used but are difficult to move.
- o Record all initial information on the Air Sampling Data Sheet (Figure FS-4.6). Include sample number, description, date, time, counter reading, flow rate, wind speed and direction, ambient temperature, name of person collecting sample, pump number, and any comments pertinent to the sampling event.
- o Start air sampling pump and observe system to determine if appropriate flow rate is being maintained. Most constant flow sampling pumps have low flow indicators and/or an automatic shut-off feature at low flow conditions. If present, these features should be initially observed and periodically monitored during the course of sampling.
- o Allow pump to run for desired sampling time (typically 4 to 8 hours).
- o At the end of the sampling period, observe rotometer level or low flow indicator to determine if flow rate has been maintained. Shut down sampling pump and record all pertinent information (counter reading, time, wind direction, wind speed, ambient temperature, problems, comments, etc.) on the air sampling data sheet (Figure FS-4.6). The final flow rate should not deviate from the initial flow rate by more than ± 5 percent.
- o Remove sorbent cartridge (use clean, lint-free gloves) and place in culture tube. Place cartridge in culture tube with the inlet facing up and mark accordingly on the outside of the culture tube. Do not place any marking on the cartridge itself.
- o Place plugs of glass wool below and above the cartridge and tightly cap and label the culture tube. Before proceeding with the packing, the tube should be shaken to insure that the cartridge does not rattle inside the culture tube.
- o Analysis should be instituted as quickly as possible to prevent sample degradation. Culture tubes should be wrapped in foil to limit exposure of sampling cartridges to UV light.
- o Cartridges will be transported in solvent free coolers packed with ice or frozen gel packs and stored at 4 degrees Celsius while awaiting analysis.



LANDAU ASSOCIATES, INC.

Air Sampling Data Sheet

Figure FS-4.6

4.3.3 Air Quality Control Samples

One blank sorbent tube will accompany weekly sorbent tube shipments to and from the site. In addition, approximately every tenth sorbent tube sample collected from both upwind and downwind of the treatment system will be collected as a duplicate. Duplicate samples will be collected at the same flow rate, location, and time period as the original sample.

4.3.4 Chain of Custody

Place sample identification label on culture tube and complete a Chain-of-Custody Record similar to that shown on Figure FS-4.2. The Chain-of-Custody Record will establish the documentation necessary to trace sample possession from the time of collection. A Chain-of-Custody Record will be completed and will accompany every sample delivery to the laboratory. The record will contain the following information:

- o Sample identification number,
- o Name of sampler,
- o Date and time of collection,
- o Signature of persons involved in the chain of possession (the sampler will be the first person to relinquish custody), and
- o Inclusive dates of possession.

The Chain-of-Custody Record will be completed in duplicate for all soil samples sent to the laboratory. Copies of the Chain-of-Custody Records will be retained by the laboratory, in the Landau project file, and by the Landau QAC. The laboratory will include a copy of the Chain-of-Custody Record in its report of analytical results.

4.3.5 Chain-of-Custody Seal

A Chain-of-Custody Seal similar to that shown on Figure FS-4.3 (used to detect unauthorized tampering with the samples) will be placed on the ice chest after the collection of all samples. The seal will include, at a minimum, the sampler's name and the date. The seal must be attached such that it must be broken in order to open the ice chest. Seals must be affixed to the ice chest before the sampling personnel will relinquish custody of the samples.

4.3.6 Field Records

Field log books, the Air Sampling Data Sheet, and the Sample Collection Form, will be used to record all information pertinent to the sampling event. The records will contain sufficient information to permit reconstruction of sampling events without reliance on the sampler's memory. All field records will be retained by the Landau Field Coordinator and secured in a safe place.

4.3.7 Shipment of Samples

Sorbent tube samples will not be shipped in coolers containing any other types of samples. A Sample Analysis Request Packing List (Figure FS-4.4) will accompany the samples sent to the laboratory. This form will be completed by field personnel and will specify to the laboratory the analyses to be performed. The samples will be shipped to the laboratory within 24 hours of sampling, except as noted in Section 5.1 for samples collected on Friday. Sorbent tube samples will also be accompanied by a Chain-of-Custody Record and the Air Sampling Data Sheet. The samples will be delivered to the laboratory representative authorized to

receive samples, and Chain-of-Custody Records signed to verify delivery/receipt.

4.4 SOIL SAMPLING

Soil sampling during borehole advancement will be performed for geologic/hydrogeologic purposes only. Approximately one to three samples from each boring will be analyzed for grain size, unit weight, and water content. Details of well construction activities, including soil sampling, are provided in the Colbert Landfill Phase I Ground Water Monitoring Well Construction Plan (Landau Associates, Inc. 1989). Soil samples collected for geologic/ hydrogeologic characterization will not require specially cleaned laboratory supplied sample bottles.

Sample labels are necessary to properly identify samples. Gummed paper labels or tags will be used and will include the following information:

- o Sample identification number,
- o Sampling date and time,
- o Sample location,
- o Name of sampler,
- o Depth of sample, and
- o Pertinent field information.

Labels will be completed and affixed to sample containers prior to or at the time of sampling.

Soil sampling equipment will be washed to prevent cross contamination within (and between) borings by using the following procedure:

- o Scrubbing with a brush using a solution of clean water and Alconox. This solution will be changed if it becomes muddy or obviously contaminated.
- o Rinsing with clean water. This will be performed by pouring clean water over the equipment until all soapy residue is removed.
- o Rinsing with distilled water by pouring distilled water over the equipment.

Soil samples will be stored at the project office for review. Following completion of Phase I activities (or at a later date, if appropriate), the samples will be disposed of at the landfill site.

5.0 SAMPLE HANDLING AND ANALYSIS

Sample container description, preservation method, and the maximum holding time for analysis are presented for each sample type in Table FS-4.1.

Samples will be shipped to the laboratory Monday through Thursday. Samples will not be shipped on Friday.

Samples collected on Friday will typically be stored in a refrigerated area over the weekend, and shipped to the laboratory on Monday.

All samples except those that are preserved with acid (nitrate, COD, TOC, TOX, and metals) will be sent to the laboratory as environmental samples. Environmental samples will be shipped as follows:

Each sample will be placed in a separate plastic bag. A picnic cooler will be used as a shipping container. In preparation for shipping samples, the drain plug will be taped shut from the inside and outside, and a large plastic bag will be used as a liner for the cooler. Approximately 1 inch of packing material, such as asbestos-free vermiculite, will be placed in the bottom of the liner. The sample bottles will be placed in the lined cooler. All coolers will contain ice or frozen gel packs. The lined cooler will be filled with packing material, and the large liner bag will be taped shut. Sufficient packing material will be used to prevent sample containers from making contact during shipment. The paperwork going to the laboratory will be placed inside a plastic bag and taped inside the cooler lid.

The cooler will be taped shut with strapping tape. Chain-of-Custody seals will be placed on the cooler (Figure FS-4.3). The cooler will either be shipped on an overnight carrier or transported by automobile.

Samples preserved with acid will either be transported directly to the laboratory by automobile, or will be shipped on an overnight carrier (cargo aircraft only) as hazardous samples. If these samples are shipped on an overnight carrier, they will be packaged as follows:

Each sample bottle will be placed in a separate plastic bag. As much air as possible is squeezed from the bags before sealing. Each bottle will be placed in a separate paint can. The paint can will be filled with vermiculite, and the lid will be fixed to the can. The lid will be sealed with metal clips or with filament tape. Arrows will be placed on the can to indicate which end is up. The outside of the can will contain the proper Department of Transportation (DOT) shipping name and identification number for the sample as given by 49 CFR-171-177. The information will be printed legibly. The cans will be placed upright in the cooler that has had its drain plug taped shut inside and out, and that has been lined with a large plastic bag. The bag liner will be partially filled with vermiculite, and will then be taped shut.

The paperwork going to the laboratory will be placed inside a plastic bag and taped to the inside of the cooler lid. The cooler will be closed and sealed with strapping tape. At least two custody seals will be placed on the outside of the cooler (one in front and one on the back).

The following markings will be placed on the top of the cooler:

- o Proper shipping name (49 CFR 172.301);
- o DOT identification number (49 CFR-172.306);
- o Shipper's name and address (49 CFR-172.306);
- o Corrosive Liquid, N.O.S.; and
- o "Cargo Aircraft Only."

An arrow symbol indicating "This Way Up" will be placed on the cooler in addition to the markings and labels described above. A restricted article airbill will be used for shipment.

APPENDIX QA-B

SAMPLING FORMS

- o Sample Collection Form
- o Sample Analysis Request Packing List
- o Log of Exploration Form
- o Chain of Custody Record
- o Chain of Custody Seal
- o Air Sampling Data Sheet

SAMPLE COLLECTION FORM

SAMPLE NUMBER

Collector _____

Proj. Name _____ Job No. _____

Sample Location & Depth _____

Sample Type: Soil, Ground Water, Other _____

Date Collected (d/m/yr) _____ Time (24-hr.) _____

Weather _____

Sample Collected With: Bailer; Pump; Split Barrel; Other _____

Made of: Stainless Steel; PVC; Teflon; Other _____

PURGE DATA

Depth to Water (top of PVC): _____

(d/m/y/hr)

Begin _____ One Casing Vol. (gal) = _____

End _____ Gallons Purged = _____

(Remove 3 well volumes or until dry)

Description (color, texture, density, moisture, turbidity, etc.)

_____FIELD
PARAMETERS

Replicate

pH

Cond. (uS)

Temp.:

1

2

3

4

F C

Meter used for measurement: _____

Sample composited over time, distance: _____

Quantity, types of sample containers: _____

Duplicated sample number(s): _____

Well Condition:

(1. Well caps are secure and operational; 2. Visible damage to well)

Comments (why analyze; calculations; etc.)

Signature _____

Date (d/m/y) _____

LANDAU ASSOCIATES, INC.
SAMPLE ANALYSIS REQUEST PACKING LIST

SAMPLER: <hr/>	Sampling Date(s): <hr/>	Ship To: <hr/>	For Lab Use Only <hr/>
Sampling Contact: <hr/>	Date Shipped: <hr/>	Attn: <hr/>	Date Samples Rec'd <hr/>
(name) <hr/>	Site Name/Code: <hr/>		Rec'd By: <hr/>
(phone number) <hr/>	<hr/>		<hr/>

Sample Numbers	Sample Description i.e., Requested Analysis, Matrix, Concentration	Sample Condition on Receipt at Lab
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____
11. _____	_____	_____
12. _____	_____	_____
13. _____	_____	_____
14. _____	_____	_____
15. _____	_____	_____
16. _____	_____	_____
17. _____	_____	_____
18. _____	_____	_____
19. _____	_____	_____
20. _____	_____	_____

For Lab Use Only

Log of Exploration

Client/Owner _____
Project No. _____
Exploration No. _____
Start Date _____ Hour _____
Ground Surface Conditions _____
Weather Conditions _____
Landau Representative _____
Contractor/Operator _____
Drill Type/Method _____
Hammer Weight & Stroke _____

LOCATION SKETCH
(show dimensions to mapped features)



Surface Elevation _____ Datum _____

☐ No Recovery

☒ Disturbed Sample

☐ Undisturbed Sample

Sample No.	Sampler Type	Penetration Resistance/6"	Length Driven	Sample Length Recovered	Sample Depth (ft.)	Graphic Recovery	Depth Scale	Unified Symbol	WATER LEVEL INFORMATION					
									Date					
									Time					
									Depth to Water					
									Hole Depth					
									Casing Depth					
									SOIL DESCRIPTION				COMMENTS	
							0							
							1							
							2							
							3							
							4							
							5							
							6							
							7							
							8							
							9							
							0							
							1							
							2							
							3							
							4							
							5							
							6							
							7							
							8							
							9							
							0							

Sampler: D/M, SPT, Thinwall (TW), Shelby Tube (S), Bulk (B), etc.
(Add 'C' to sampler type if a catcher is used)

Finish Date _____ Hour _____ Cont. ☐

Landau Associates, Inc.
Edmonds, WA (206) 778-0907

Chain of Custody Record

Date _____
Page _____ of _____

[illegible]

Chain of Custody Seal

Person Collecting Sample _____ (signature) No. of Samples _____

Date Sealed _____ Time Sealed _____

Location _____

LANDAU ASSOCIATES INC.
AIR SAMPLING DATA SHEET

[illegible]

APPENDIX QA-C

FIELD INSTRUMENTATION USE/CALIBRATION PROCEDURES

- o Photoionization Meter
- o Hydrogen Sulfide, Oxygen, and
Combustible Gas Indicator
- o pH Meter
- o Conductivity Meter
- o Thermometer

PHOTOIONIZATION METER

Calibration Procedure*

Model: Photovac TIP II Air Analyzer

- (1) Set span adjustment knob and zero adjustment knob at 4.5.
- (2) Zero meter with coarse adjustment. Use insulated screwdriver for adjustment.
- (3) Hook meter up to 100 ppm isobutylene. Meter should read greater than 100 ppm.
- (4) Turn span adjustment until the meter reads 100 ppm.
- (5) Remove gas from meter.
- (6) Take a reading of the ambient air. Reading should be negative.
- (7) Zero meter with zero adjustment.

The TIP II photoionization meter has a nickel-cadmium battery. When fully charged, the battery should last over two hours of continual use. When the battery is low, a "low bat" will display on the LCD. When the low bat is displayed the instrument does not give accurate results.

The TIP II should only be charged when it has been run down to the low bat. It should be charged for approximately 16 hours. Do not overcharge or undercharge the battery. If these rules are not followed, the battery will be impaired, greatly reducing the usefulness of the meter.

* Appropriate instructions will be inserted to this Appendix if other instruments are utilized.

The TIP II meter should be calibrated every day of field use. Once the TIP II meter has been calibrated, it will give an absolute reading if it is reading gas that is 100 percent isobutylene. Otherwise, it will give a reading relative to isobutylene.

HYDROGEN SULFIDE, OXYGEN, AND COMBUSTIBLE GAS INDICATOR

Calibration Procedure

Model: MSA Hydrogen Sulfide, Combustible Gas and Oxygen Alarm
Model 361

Test the operation of the pump and sample flow indicator by momentarily placing a finger over the sample inlet of the instrument. The flow indicator should be at the top of the window before falling from view while the inlet is blocked. If not, see the instrument Instruction Manual for required maintenance.

- (1) Attach the flow control valve to the 0.75 percent pentane and 15 percent oxygen calibration gas tank.
- (2) Connect the adapter-hose to the flow control valve.
- (3) Open the flow control valve.
- (4) Connect the adapter-hose fitting to the inlet of the instrument; after approximately 15 seconds, the LEL meter should stabilize and indicate between 47 and 55 percent. If the indication is not in the correct range, remove the right end of the indicator and adjust the internal LEL SPAN control to obtain 50 percent.
- (5) Verify the oxygen reading; it should be between 13 and 17 percent. (This is a response check only, no internal adjustments are necessary. The oxygen sensor should be calibrated to 20.8 percent oxygen in fresh air before each use. This is accomplished by adjusting the oxygen span control on the front panel.)
- (6) Disconnect the adapter-hose fitting from the instrument.
- (7) Close the flow control valve.
- (8) Remove the flow control valve from the calibration gas tank.

- (9) Attach the flow control valve to the hydrogen sulfide calibration gas tank.
- (10) Open the flow control valve.
- (11) Connect the adapter-hose fitting to the inlet of the instrument; after approximately one minute, the TOX readout should stabilize and indicate 7 to 13 ppm. If the indication is not in the correct range, remove the right end of the indicator and adjust the internal TOX SPAN control to obtain 10 ppm.
- (12) Disconnect the adapter-hose fitting from the instrument.
- (13) Close the flow control valve.
- (14) Remove the adapter-hose from the flow control valve.
- (15) Remove the flow control valve from the calibration gas tank.

pH METER

The pH of the ground water and treatment system samples will be measured using EPA method 9040. The manufacturer's instructions for calibration and use will be followed. A two buffer calibration with Automatic Temperature Compensation (ATC) will be used at a minimum of every four hours during sampling. The manufacturer's instructions follow:

MEASUREMENT PROCEDURES

pH Measurements

For maximum accuracy:

Perform a two buffer calibration once at the beginning of each day. This procedure provides the correct setting for the °C/slope control. Subsequent measurements can be made after a single buffer calibration.

Use ATC probe to automatically compensate for changes in slope due to variations in sample temperature.

Two Buffer Calibration (With ATC)

1. Plug ATC probe into input jacks and adjust °C/slope control knob to 25°C. Slide mode switch to temperature. Verify that ambient temperature is displayed.
2. Place electrodes in pH 7 buffer and stir moderately.
3. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that correct buffer value at that temperature is displayed.
4. Remove electrodes from the buffer solution, rinse, and place electrodes in second buffer. Stir moderately. Allow reading to stabilize.
5. Adjust °C/slope control until correct value of second buffer is displayed. Remove electrodes from solution, rinse and place electrodes in sample. Stir moderately. Allow reading to stabilize.
6. Record pH value displayed.

Two Buffer Calibration (Without ATC)

1. Sample and buffer temperature must be equal. Set °C/slope control to buffer temperature (°C).
2. Place electrode in pH 7 buffer and stir moderately.
3. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that correct buffer value at that temperature is displayed.
4. Remove electrode from the buffer solution, rinse, and place electrode in second buffer. Stir moderately. Allow reading to stabilize.
5. Adjust °C/slope control until correct value of second buffer is displayed. Remove electrode from solution, rinse and place electrode in sample. Stir moderately. Allow reading to stabilize.
6. Record pH value displayed.

If sample temperature differs significantly from the buffer temperatures used to calibrate, an adjustment can be made. Raise or lower the °C/slope control from its current setting, described in step 5, by the difference between the actual buffer temperature and the sample temperature. For maximum accuracy use ATC probe.

Single Buffer Calibration (With ATC)

The ATC probe replaces the manual temp/slope control on front panel with automatic compensation based on sensed sample temperature.

1. Plug ATC probe into input jacks and adjust °C/slope control knob to 25°C. Slide mode switch to temperature. Verify that ambient temperature is displayed.
2. If incorrect, adjust °C/slope control knob until actual temperature is displayed.
3. Place electrodes in a buffer solution with pH value within 1.5 units of the expected sample value and stir moderately.
4. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that pH value of buffer is displayed.
5. Remove electrodes from the buffer solution, rinse, and place electrodes into sample. Stir moderately. Allow reading to stabilize.
6. Record pH value displayed.

Single Buffer Calibration (Without ATC)

1. Sample and buffer temperature must be equal. Set °C/slope control to buffer temperature (°C).
2. Place electrode in a buffer solution with pH value within 1.5 units of the expected sample value and stir moderately.
3. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that correct buffer value at that temperature is displayed.
4. Remove electrodes from the buffer solution, rinse, and place electrodes into sample. Stir moderately. Allow reading to stabilize.
5. Record pH value displayed.

CONDUCTIVITY METER

The conductivity of the ground water and treatment system samples will be measured using EPA Method 9050. The manufacturer's instructions follow.

Model: Amber Science Series 500 #604 Conductivity Meter

CONDUCTIVITY STANDARDS

Approximate Normality	Weight of KCl in grams/1000 grams of Solution	Conductions in Micromhos @ 25°C
1.	71.1352	111,342
.1	7.41913	12,856.0
.01	.745263	1,408.77

MAKING CONDUCTIVITY & TDS MEASUREMENTS
with The Model 604

- I Cell Constant determination
Power "ON" (Lo Batt not on)
Cell connected
Function to A. T. C. "ON"
Range to "2000" $\mu\Omega$

Using three samples of the 718 $\mu\Omega$ standard solution (shipped with the Model 604), held at 25°C, dip the cell in the first solution. Allow the cell to temperature equilibrate to the standard solution. Withdraw cell and dispose of excess solution. Do not touch or wipe off the cell. Repeat this process in the second solution. Place the cell in the third solution for measurement. Measurement is to be made once cell is in the third solution. This reading will be most accurate if the measurement is made as soon as the cell is dipped in the third solution. Readings may change in some cases due to gases or other impurities absorbed from the atmosphere. Using the calibration tool set the standardize control to display .718. By changing the Function Switch to the standardize position, the constant maybe read directly from the display. (Example: 9.96; 10.00; 10.04). The Instrument is now ready to make percise conductivity measurements. In making measurements of unknown solutions, select '200,000' on Range Switch, ATC "ON" with Function Switch. Using three samples of the 'unknown solution', rinse the cell in the first sample solution.

Allow the cell to temperature equilibrate in the solution. Withdraw cell and dispose of excess solution. Do not touch or wipe off cell. Repeat this process in the second sample solution. Place the cell in the third solution for measurement. Measurement is to be made as soon as cell is in the solution. Having selected the appropriate range for reading, record same.

CALIBRATION & MAINTENANCE

Preventative Maintenance

1. The Model 604 requires no periodic maintenance.
2. Cleaning of the Model 604 should be done with a mild soap solution and a damp cloth.

CAUTION

DO NOT ALLOW FLUIDS TO RUN INTO THE INSTRUMENT.

ZERO CALIBRATION

Checking for proper Zero of Instrument.

Select ATC "ON"

Power "ON"

Cell connected (Dry & Clean)

Select these two ranges - 2 & 200,000 micromhos. In both positions the Digital Display should read 0 plus or minus a count. If not a Zero Calibration should be performed.

Remove four attaching screws on back of cover. Remove back cover. Consult the Component Layout Diagram (Reverse Side) in this publication for the location of R49 & R69. Diagram is found on page 12. R49 & R69 maybe accessed from reverse side of board. Holes are provided in PC Board for this purpose.

Instrument Power "ON"

Function Switch ATC "ON"

Range Switch "200,000"

Cell connected (Dry & Clean)

Adjust R49 for zero reading. Position Range Switch to "2". Adjust R69 for a Zero reading. This completes Zero Calibration. Reassemble the Instrument.

USER INFORMATION

1. Care must be taken to avoid solution 'carry over'. The cell should be rinsed in a sample of the solution to be measured before the actual measurement is made.
2. Equilibrating the Cell - Agitate the cell in the solution to expediate temperature equilibration, and also assists in the dislodging of air bubbles
3. Immersion of Cell - Cell is to be immersed in the solution a minimum of 1½ inches for proper measurement.
4. Therminster Time Constant - The Cell's Therminster time constant is approximately eighteen seconds.
5. Sample Measurements - Minimum amount of solution required for measurement - 1 ml in 10 mm test tube (ID).

THERMOMETER

Model: Taylor Pocket Thermometer #21430-1
(Range = 30° to 50° C)

1. Thermometer Calibration Procedure

- a. Each thermometer is labeled with an identifying number. The thermometer calibration will be documented in a dedicated calibration log book. All instrument calibrations and repairs will be recorded in the calibration log. The log book will describe the thermometer (make, model, purchase date, serial number, probe type, etc.).
- b. All thermometers will be calibrated against an NBS traceable thermometer. This thermometer will not be used in the field but will be retained in the Landau laboratory as a calibrated standard.
- c. Thermometers will be calibrated immediately after purchase and every six months thereafter, or if any unusual readings are obtained.

2. Temperature Measurement Procedure

- a. Immediately prior to calibration, the operator will enter his name, the date, and time of calibration in the log book. The instrument will be calibrated indoors.
- b. A two-point calibration will be conducted as follows: first, both the thermometer being calibrated (i.e., the field thermometer) and the NBS-traceable thermometer will be immersed in a container of ice and water. After waiting for the reading to stabilize, the operator will record both readings and calculate the error on the field thermometer. The procedure will be repeated with the

water at room temperature (approximately 20-25° C). The field thermometer will be considered to be calibrated if it reads within 1° C of the NBS-traceable thermometer (i.e., $\pm 1^\circ$ C). The information will be recorded as follows:

Initials	Date ddmmyy	Time	Temp NBS	Temp Field	Error (Field-NBS)
JML	3/3/88	1324	0.5	1	+0.5
JML	3/3/88	1324	18	19	+1.0

APPENDIX QA-D
FIELD AND LABORATORY
AUDIT CHECKLISTS

The field and laboratory checklists presented in this appendix are duplicates of audit checklists used by the EPA's National Enforcement Investigations Center (NEIC 1984) in Denver, Colorado. These checklists have been selected for use on this project because they represent approved EPA audit checklists and reflect a standard of audit review appropriate to the project scope.

Selected audit observations in both the field and laboratory checklist may not be applicable to this project. When completing the audit checklists, the auditors will indicate non-applicable observations by checking the corresponding "N/A" entry on this checklist.

Field Operations Audit Checklist

STRATHMORE WRITING

25% COTTON FIBER

FIELD CHECKLIST
Field Observations

Yes__ No__ N/A__

1. Was permission granted to enter and inspect the facility? (Required if RCRA inspection)

Yes__ No__ N/A__

2. Is permission to enter the facility documented? If yes, where is it documented?

Yes__ No__ N/A__

3. Were split samples offered to the facility? If yes, was the offer accepted or declined?

Yes__ No__ N/A__

4. Is the offering of split samples recorded? If yes, where is it recorded?

Yes__ No__ N/A__

5. If the offer to split samples was accepted, were the split samples collected? If yes, how were they identified?

Yes__ No__ N/A__

6. Are the number, frequency and types of field measurements and observations taken as specified in the project plan or as directed by the project coordinator? If yes, where are they recorded?

Yes__ No__ N/A__

7. Are samples collected in the types of containers specified for each type of analysis? If no, what kind of sample containers were used?

Yes__ No__ N/A__

8. Are samples preserved as required? If no or N/A, explain.

Yes__ No__ N/A__

9. Are the number, frequency and types of samples collected as specified in the project plan or as directed by the project coordinator? If no, explain why not?

Yes__ No__ N/A__

10. Are samples packed for preservation when required (i.e., packed in ice, etc.)? If no or N/A, explain why.

Yes__ No__ N/A__

11. Is sample custody maintained at all times? How?

FIELD CHECKLIST
Document Control

- Yes__ No__ N/A__ 1. Have all unused and voided accountable documents been returned to the coordinator by the team members?

- Yes__ No__ N/A__ 2. Were any accountable documents lost or destroyed? If yes, have document numbers of all lost or destroyed accountable documents been recorded and where are they recorded?

- Yes__ No__ N/A__ 3. Are all samples identified with sample tags? If no, how are samples identified?

- Yes__ No__ N/A__ 4. Are all sample tags completed (e.g., station no., location, date, time, analyses, signatures of samplers, type, preservatives, etc.)? If yes, describe types of information recorded.

- Yes__ No__ N/A__ 5. Are all samples collected listed on a chain-of-custody record? If yes, describe the type of chain-of-custody record used and what information is recorded.

- Yes__ No__ N/A__ 6. If used, are the sample tag numbers recorded on the chain-of-custody documents?

- Yes__ No__ N/A__ 7. Does information on sample tags and Chain-of-Custody Records match?

- Yes__ No__ N/A__ 8. Does the Chain-of-Custody Record indicate the method of sample shipment?

- Yes__ No__ N/A__ 9. Is the Chain-of-Custody Record included with the samples in the shipping container?

- Yes__ No__ N/A__ 10. If used, do the sample traffic reports agree with the sample tags?

- Yes__ No__ N/A__ 11. If required, has a receipt for samples been provided to the facility (required by RCRA)? Describe where offer of a receipt is documented.

- Yes__ No__ N/A__ 12. If used, are blank samples identified?

- Yes__ No__ N/A__ 13. If collected, are duplicate samples identified on sample tags and Chain-of-Custody Records?

- Yes__ No__ N/A__ 14. If used, are spiked samples identified?

- Yes__ No__ N/A__ 15. Are logbooks signed by the individual who checked out the logbook from the project coordinator?

- Yes__ No__ N/A__ 16. Are logbooks dated upon receipt from the project coordinator?

- Yes__ No__ N/A__ 17. Are logbooks project-specific (by logbook or by page)?

- Yes__ No__ N/A__ 18. Are logbook entries dated and identified by author?

- Yes__ No__ N/A__ 19. Is the facility's approval or disapproval to take photographs noted in a logbook?

- Yes__ No__ N/A__ 20. Are photographs documented in logbooks (e.g., time, date, description of subject, photographer, etc.)?

- Yes__ No__ N/A__ 21. If film from a self-developing camera is used, are photos matched with logbook documentation?

- Yes__ No__ N/A__ 22. Are sample tag numbers recorded? If yes, describe where they are recorded.

Yes__ No__ N/A__ 23. Are calibration of pH meters, conductivity meters, etc., documented? If yes, describe where this is documented.

Yes__ No__ N/A__ 24. Are amendments to the project plan documented? If yes, describe where the amendments are documented.

FIELD CHECKLIST
Debriefing with Project Coordinator

Yes__ No__ N/A__

1. Was a debriefing held with project coordinator and/or other participants?

Yes__ No__ N/A__

2. Were any recommendations made to the project participants during the debriefing? If yes, list recommendations.

LABORATORY CHECKLIST
Debriefing with Laboratory Personnel

1. List observations made by the auditor.

2. Make recommendations with respect to each observation.

3. Discuss observations and recommendations made by the auditor.

LABORATORY CHECKLIST

SIGNATURE OF AUDITOR _____ DATE OF AUDIT _____
LABORATORY _____ CEAT PROJECT NO. _____
LABORATORY LOCATION _____
CONTRACTS IN EFFECT _____

(List Contract Numbers)

1. Name of Sample Custodian and other personnel responsible for sample receipt and document control.

2. Where are the Sample Custodian's procedures and responsibilities documented?

3. Where are written Standard Operating Procedures (SOPs) pertaining to receipt of samples documented (laboratory manual, written instructions, etc.)?

4. Where is the receipt of Chain-of-Custody Record(s) with samples being documented?

5. Review sample receipt documentation to assure that the nonreceipt of chain-of-custody record(s) with samples is being documented.

6. Where is the integrity of the shipping container(s) being documented (custody seal(s) intact, container locked or sealed properly, etc.)?

7. Review the sample receipt documentation to assure that the lack of integrity of the shipping container(s) is being documented (i.e., evidence of tampering, custody seals broken or damaged, locks unlocked or missing, etc.)?
-
-
8. Determine, by asking the Sample Custodian or reviewing the laboratory SOP manual, if agreement among Sample Management Office forms, chain-of-custody records, and sample tags is being verified? State source of information.
-
-
9. Where is the agreement or nonagreement verification being documented?
-
-
10. Review sample receipt documentation to assure that sample tag numbers are recorded by the Sample Custodian?
-
-
11. Where are written Standard Operating Procedures (SOPs) pertaining to sample storage documented (laboratory manual, written instructions, etc.)?
-
-
- 12a. Do written SOPs and actual laboratory practices demonstrate laboratory security?
-
-
- 12b. Describe sample storage area (upright refrigerator in GC lab, walk-in cooler in sample receiving area, etc.).
-
-
13. How is sample identification maintained?
-
-

14. How is sample extract (or inorganics concentrate) identification maintained?
-
-
15. How are samples that require preservation stored to maintain their preservation?
-
-
16. How are written Standard Operating Procedures (SOPs) pertaining to sample handling and tracking documented?
-
-
17. What laboratory records are used to record personnel receiving and transferring samples in the laboratory?
-
-
18. Affirm that each instrument used for sample analysis (GC, GC/MS, AA, etc.) has an instrument log? List those instruments which do not.
-
-
19. Determine where analytical methods are documented and ask if methods are available to the analysts?
-
-
20. Determine where quality assurance procedures are documented and ask if procedures are available to the analysts?
-
-
21. How are written Standard Operating Procedures (SOPs) for compiling and maintaining sample document files documented?
-
-

22. How are sample documents filed (by case number, internal laboratory number, batch number, sample number, etc.)?

23. Review sample document files to determine if a document file inventory is prepared for each case file.

24. Review sample document files to determine if all documents in the case files are consecutively numbered according to the file inventories.

25. Observe the document file storage area to determine if the laboratory document files are stored in a secure area.

26. Has the laboratory received any confidential documents?

Complete questions 27, 28 and 29 ONLY if the response to question 26 was yes.

27. Review the case files to assure that confidential documents are segregated from other laboratory documents.

28. Review the case files to assure that confidential documents are stored in a secure manner.

30. Review recommendations from the previous audit to determine if the recommendations have been implemented. If not, the recommendations should be repeated and the laboratory director and the Project Officer should be notified.